IN THIS ISSUE—DEVELOPING THE METAL WARE

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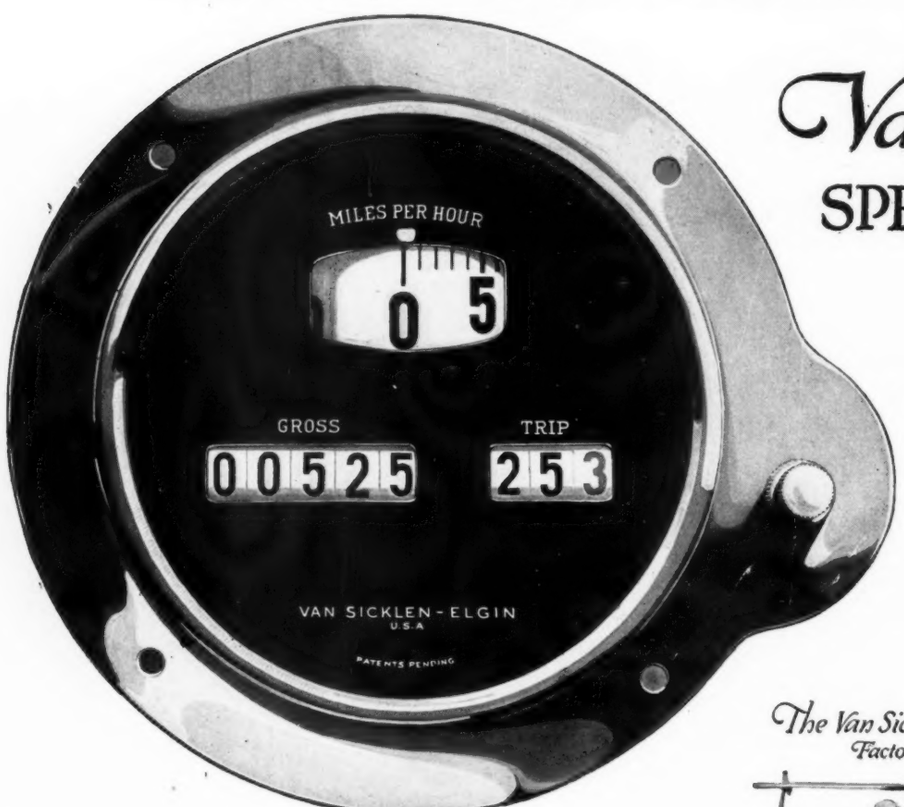

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The Automobile and Automotive Industries

Vol. XXXVII New York—Thursday, October 4, 1917—Chicago No. 14

Wheels Will Be Metal

End of the Wood Wheel in Sight—Passenger Cars Will Use Pressed Steel Wheels of Many Forms—Pressed Disk Wheels in Truck Field Compete with Cast Types—New Alloys May Give Much Lighter Wheels

By A. Ludlow Clayden

THERE is little doubt that wood will ultimately disappear altogether from automobiles and trucks. Although wood is still the most favored material for wheels and for body frames, it is not possessed of the lasting qualities of metal, and every year there is more metal and less wood employed. In body work there are two substitutes for the wood frame, the cast aluminum body as used by Pierce-Arrow, probably the best body in the world, and the pressed-steel welded body used by Dodge. The former is good and expensive, the latter is good and cheap. The aluminum body has more solidity, is stronger and more rigid; the pressed steel construction lends itself to large production and economy. With either, it is an expensive proposition to prepare for the production of a new shape, the pressed steel costing most in this respect. It is usually assumed that the die cost for pressed steel bodies must be spread over 20,000 identical bodies before it can show a cost advantage over the wood and steel body which is the conventional sort to-day.

Hickory Supplies Exhausted

In wheels the tendency is to stick to the wood article. The trend toward steel is not due to any saving in cost, but is explained largely by the increasing scarcity of good wood. Second growth hickory has almost vanished from the market, and the wood available for wheels is now far below the average quality of five years ago. In Europe there was never any good wheel wood except the imported hickory. Consequently most of the wheels used on the earlier cars were of oak or other woods not so good for the purpose as hickory. As a result the steel wheel, whether a wire construction or of some other form, was stronger than the conventional wood wheel; and the wood wheel, being made of unsuitable wood, was apt to loosen and give trouble. Because of this it was made heavier than a hickory wheel would have been, which enabled wire wheels to show a substantial weight advantage as well as one of strength.

Wire Wheel Is Fashionable

In America, the hickory wheel was so good and so cheap that the wire wheel had a much harder fight to establish itself; in fact the wire wheel has gained practically in proportion as hickory has fallen off in quality. This is a fact which may be a coincidence, however, because it is difficult to decide how much the popularity of the wire wheel is due to its qualities and how much to fashion. The fashion for the wire wheel follows an easily observed route. The detachable feature, plus the strength and light weight, led to the adoption of wire wheels for racing. This led to their use on "sports" cars, and so to the wider use they enjoy to-day.

In Europe events moved along another channel. Here the demountable rim never had much vogue; the soft bead clincher tire and the more extensive employment of professional drivers did not encourage the development of labor saving rims in the old world. The demountable feature of the wire wheel was advertised just about the same time that motoring became general in Europe. It coincided with the end of the days in which all cars were driven either by skilled chauffeurs or by enthusiasts. It came along just as the ordinary man was beginning to use automobiles for convenience as they are used in America to-day. The detachable wheel offered the simplest and quickest method of changing a tire then known; there were few rims to compete, Michelin having almost the only one, and that a type requiring a large number of nuts to be removed and replaced. Five

years ago the wire wheel with the fixed clincher rim was unquestionably the best equipment that British and Continental makers had to offer.

None the less, an alternative appeared and grew, this being the detachable pressed steel wheel. Wire wheels had established the detachable feature in preference to the demountable rim, and the pressed steel wheel manufacturers followed the easy road. They tried to give a detachability nearly as facile as the wire wheel, a strength nearly as great, a weight nearly as low, and a price considerably lower.

The most widely used wheel in England to-day is the Sankey, which is a wheel made from sheet steel. It is stamped in two halves, which are afterward welded together by the acetylene flame, and when finished it is practically indistinguishable from a wood wheel. There is an immense length of weld, as this follows the midsection of each spoke, so the Sankey wheel is not a very good manufacturing proposition. The center of the wheel is much like a wood wheel, and it is held between nave plates in the same way, but being steel it can be removed and replaced as often as desired. There are the usual bolts, customary with wood wheels, from three to six being used, according to the size of the wheel. These have cap nuts and the outer nave plate is an easy fit on the hub, so that the wheel can be pulled off directly the nuts are removed. Of course, it can be supplied with a demountable rim just as easily as a wood wheel; it merely happens that there has been only a microscopic demand for such rims.

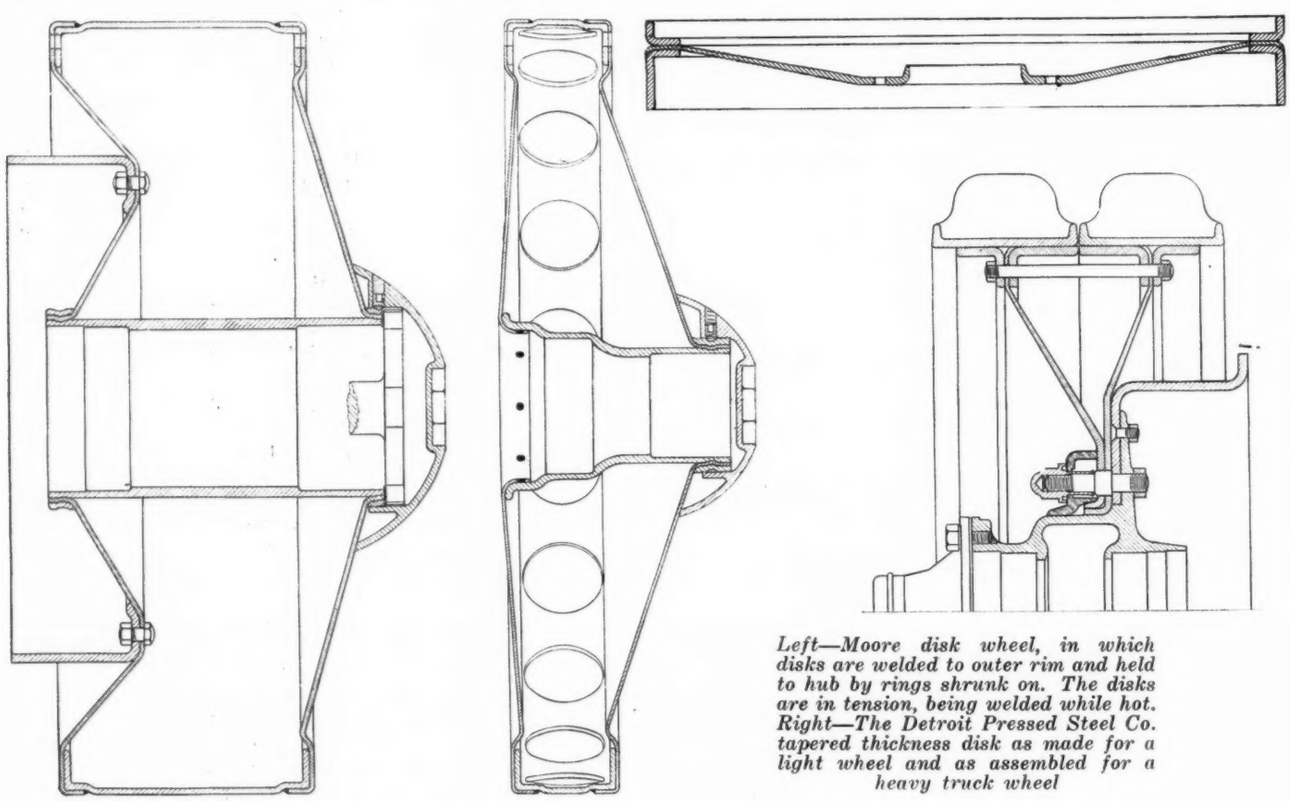
France has taken to wire wheels more slowly, and has made only slight use of pressed steel wheels, partly due to Michelin dominating the market with his rather clumsy sort of demountable rim. On the other hand, she has shown more favor toward the steel disk wheel. Since the war began Michelin has produced a wheel of this sort of very simple construction, but so far as can be ascertained the only users are the Fiat Co. These wheels are fitted to a number of Fiat ambulances and are said to be giving good satisfaction. This wheel is described as being of one thickness of sheet steel, pressed into saucer shape. The outer edge is cupped, forming a base for the attachment of the rim, and the center is just gripped between hub plates like a wood wheel. The wheel disk is convex on the outside, and the valve of the tire is accessible from the inside of the wheel. A very similar sort of wheel now on the American market is that being made by the Detroit Pressed Steel Co., which is described later.

Meanwhile in England, since about 1912, there has been an increasing tendency to inclose wire wheels in disk shields, the idea being to prevent accumulations of dirt on the spokes. A wire wheel is hard to wash and disks of aluminum or even celluloid are easily attached, making the wheel ideally easy to clean. This has got the public eye accustomed to the appearance of disks, with the result that many kinds of new disk wheels proper are being introduced.

All Steel Truck Wheels in Europe

For trucks Europe early abandoned wood. The wood being of poor quality, as has already been mentioned, its faults showed up more strongly in the heavier service. From Germany came the cast steel wheel conforming to the wooden outline, with hollow spokes, a terribly hard foundry proposition, while a British firm developed the Ajax wheel, a cast steel type with solid spokes arranged in a wonderful pattern rather reminiscent of the stone trellis work in church windows. The main object of the peculiar outline of this wheel was to provide spokes of ample strength which would not acquire permanent strains in casting, the formation being such that the wheel was actually easier to cast than the hollow spoke sort.

Meanwhile, a pressed steel wheel has been in use since earlier than 1905 known as the Lynton, this being two saucer-shaped or coned disks, spaced apart at the cen-



Left—Moore disk wheel, in which disks are welded to outer rim and held to hub by rings shrunk on. The disks are in tension, being welded while hot. Right—The Detroit Pressed Steel Co. tapered thickness disk as made for a light wheel and as assembled for a heavy truck wheel

ter, and with the rim gripped between their outer peripheries. Fiat used cast steel disk wheels many years ago and also some pressed steel patterns, these being fitted to trucks in service in 1904, if not a year before that. Mercedes has used spoked, cast steel wheels, both of the elaborate Ajax pattern and with straight spokes, for many years.

In France, where till lately trucks have been used much less proportionally than in England or Germany, the wood wheel has been the most popular. France does not readily take to outsiders' ideas, and there were small facilities in France for making either pressed or cast steel wheels.

America has tried to copy the German cast steel, hollow spoke wheel, but with small success. So far as the writer is aware the production of cast steel wheels with solid spokes has been extremely small, and there are but very few users of the steel disk wheel, the Jeffery Quad being perhaps the leading example. The Smith malleable iron wheel is a special type, combining both solid and hollow spoke ideas using a more handleable material than cast steel.

Qualities for Metal Wheel

No truck manufacturer wants any more wood wheels. Because the wood wheel eventually loosens up, because it is more liable to injury in fitting pressed on tires, the truck maker is looking for a metallic wheel that shall:

Be as strong as or stronger than wood,
Be no heavier than wood,
Be little more expensive than wood,
Be readily obtainable and even in quality.

Much the same series of requirements might easily be written down for the passenger car manufacturer, except that he is usually much less interested in durability and much more interested than the truck maker in the price which he can command.

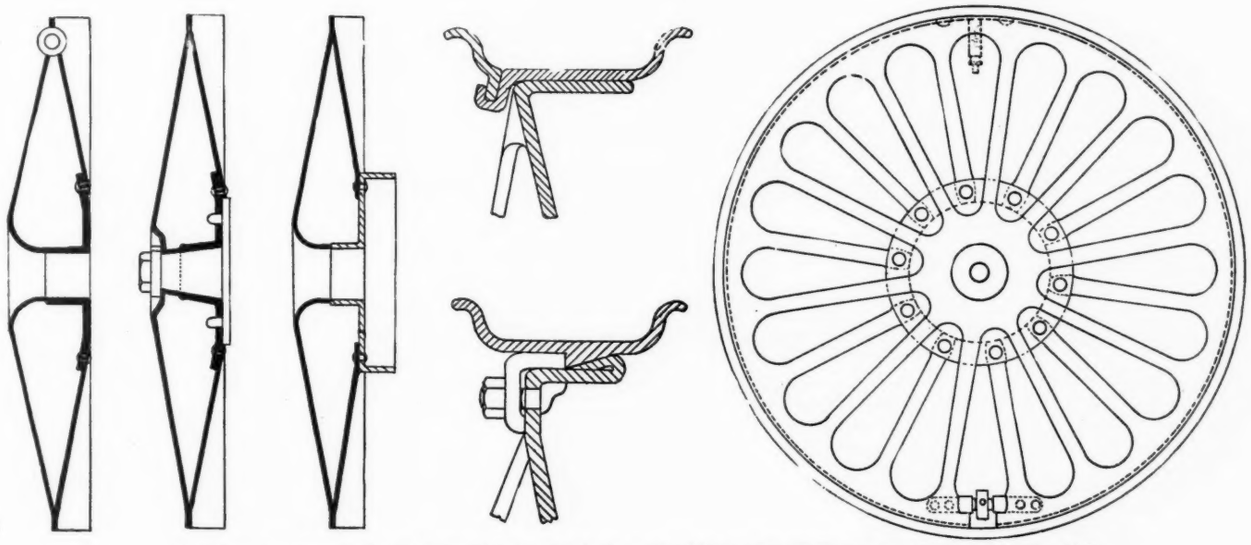
On the question of strength the advocates of different sorts of metal wheels have made many appeals which seem to be rather foolish. When the wire wheel was capturing the British market the principal makers were constantly advertising the fact that it would withstand a much heavier side blow than a wood wheel. Of course European wood wheels were notoriously weak, but even at that they were plenty strong enough. The wire wheel was much stronger than necessary. Compared with a good American hickory wheel instead of with the oak wheel of Europe the strength difference was reduced a great deal. The percentage of vehicles on which oak wheels failed for lack of strength was so small as to be entirely negligible. The percentage which failed under some sudden shock as, for example, a side blow due to skidding against a curb, was extremely small, and the side blow which would actually break a good hickory wheel is enough so to distort a wire wheel that it is almost beyond repair. Furthermore, if a wheel is so rigid that it is not damaged by a severe side shock, then it is probable that axles, springs or frame will suffer instead. The very real and outstanding advantage of a wire wheel appears to be that it is *lighter* for requisite strength rather than *stronger* for the same weight.

Labor Makes for Cost

Now the price of an article is largely made up of the labor that is put into it, and on this basis it is hard to see how a wire wheel can ever be anything but costly. Mechanically, it is the ideal wheel, not only for passenger cars but for trucks also, and improving machinery for making it may cut its cost, but it seems unlikely that it can be a competitor on a price basis with simpler metallic varieties, at least for a long time to come.

The staff of a journal like AUTOMOTIVE INDUSTRIES has an opportunity to observe many tendencies before they are generally obvious, and for the past year or more the amount of interest both among inventors and among users of wheels in the wheel subject has been remarkable. Nearly all seem to consider the disk wheel the wheel of the immediate future, or if not that, then some other shape, but made from sheet steel pressed or stamped. The Parker steel wheel, in which the hub and spokes are in one piece, and the rim bolts demountably to the spokes is an ideal way of combining the welded wheel idea as shown by Sankey in England with the demountable rim. Just why this wheel has not made more progress in the passenger car field is a puzzle. Another sort is the Baker wheel, in which the spokes are flat and all punched out of one disk of steel, being afterward bent apart alternately and welded to a hub, making a wheel with a transverse section not unlike that of a wire wheel.

In disk wheels proper, the Detroit Pressed Steel Co. has a single disk design in which the plate is reduced in thickness toward its outer edge, by an ingenious rolling process. It is finally pressed into saucer shape and bolted or riveted to hub and rim flange. Another disk idea of



Various forms of the Baker wheel, which is a double spoke form made from a single disk

an entirely different kind is the Moore wheel, which uses two disks of thin material. These are welded to both rim and hub, are conical and are welded in place while red hot, so that the cooling process puts a tension in the disks and makes the wheel a suspension type like a wire wheel.

Just to what extent the single disk wheel like the Michelin or the Detroit pressed steel is a suspension wheel is a moot point. Obviously if we consider only half a disk, but a complete rim, the single disk could work either in compression or in suspension. Probably in actual practice the upper and lower halves of the disks assist each other.

Advocates of the double disk, like the Moore or the British Lynton, claim, as a rule, lateral rigidity and stiffness akin to that of a wire wheel. On the other hand, the single disk protagonists often claim advantage for the possession of lateral elasticity, saying that it reduces wear and tear on the chassis.

Cool Pneumatic Tires

There is another claim made for metal wheels, and wire wheels in particular, namely, that they increase the life of pneumatic tires. This has been fairly well substantiated, but it is probably in no sense due to any inherent elasticity. Nothing is so destructive to tires as heat, and the heat acquired in the casing can only escape by direct radiation, or through the wheel. Any metal wheel will be a better conductor than a wood wheel, and will therefore keep the tire cooler. Probably the lowest tire temperature would be found on the metal wheel with the largest surface area in contact with air.

However, apart from the effect on tires, there seem to be two things which passenger carwheel makers have got to decide. The first, how near to the price of a wood wheel can that of a steel wheel be brought; second, what lateral strength is really desirable. Laterally the wire wheel must be the strongest, weight for weight. The question might be altered to, "Is the wire wheel too strong?" If it is then we should be able to have still lighter wire wheels, or disk wheels that are no heavier than the present wire wheel.

Nearly all the new wheel inventors, however, be they individuals with no standing in the industry or corporations which are well known, seem to have overlooked the fact that a change in wheel type so great as from the spoke to the disk offers a magnificent opportunity to eliminate a weak spot in automobile makeup and to provide an advantage for the disk wheel additional to its own good points.

Central Pivot Steering

The only proper place for the steering axis of the knuckle is dead in the plane of the wheel. Here no road shock, except a glancing blow, can tend to deflect the wheel, while with the customary type of axle every blow throws a stress on all the parts of the steering gear. It is a demonstrable fact that a vehicle with central pivot steering can be driven on a good road with only one wheel connected to the steering gear, so that turning one wheel causes the other to follow automatically. This is, of course, not practical, but it gives a good idea of the great ease of steering obtained with central pivots.

With the ordinary wheel the central pivot cannot be used without adopting a size of hub which is very ugly, according to our present ideas of automobile beauty and without the use of large diameter and therefore costly bearings. Such a hub also has the drawback of being heavy.

The disk wheel lends itself admirably to the central pivot, because it is so easily dished so as to bring wheel and knuckle pin into one plane without calling for any alteration in the size of the hub. With the double disk type the usual hub dimensions cannot be so easily applied, but the point of appearance vanishes, because the large hub dimensions are masked by the outer disk.

Another point which will affect the future development of steel wheels a good deal is whether the demountable feature is strongly desirable. At present there is not much demand for it, but the balance between the total weight of five demountable wheels with plain rims and four wheels with five demountable rims is small. There is a growing belief that of all weight that least to be desired is unsprung weight, and the detachable wheel is advantageous in case of damage, besides being much appreciated when access to axle parts immediately behind the wheel is necessary. If it were possible to agree upon some standardized hub dimensions in a series caring for different weights of car, it would be possible to develop demountable wheels which would interchange make for make. Another thing which would help the detachable type. In fact, it is to be believed that the patent wrangling over demountable hub design has done much to damage the cause of the wire wheel in America, by making the provision for wire wheels as hard as possible for the axle maker.

Still the wire wheel is here and here to stay, apparently, limited in its application by its cost. The other sorts of steel wheel are coming and their applicability will depend upon their cost, and upon little else. Nobody objects to wire wheels on the score of their odd appearance any more, and nobody will object to the look of a disk wheel within a month or two after 10,000 of them are on the roads. If one big producer of passenger cars and one big producer of trucks takes up a disk wheel of any sort, the style will become general very quickly.

Chances for Other Wheel Materials

Even supposing, however, that the wire wheel and the pressed steel or disk wheel divide the field between them in three or four years' time, which is possible, it does not by any means follow that this will be the end of wheel development. Truck wheels have been made from cast aluminum, and have done good work. The price is at present prohibitive, but the weight is low and the casting easy, because such thick sections can be used. A big saving in weight, with aluminum at say 15 cents a pound, would make the aluminum wheel worth while to the truck user, if it stands up under all conditions of service.

Then in constructions using sheet metal, or even wire, there are alloys now with the strength of steel and the weight of aluminum. In 1912 Vickers Sons and Maxim, the big British steel firm, had evolved a metal called Duralamin, which possessed these qualities, and the writer has handled a hollow spoke wheel of this substance for a 34-in. pneumatic tire that weighed less than 10 lb. By August, 1914, Duralamin was still a laboratory product, the details of quantity production not having been worked out to a point where it could be put on the market. Since the war many similar alloys have been used. The Germans have an alloy of this sort which is used for Zeppelin frames and airplane parts; there are other French and British alloys; probably Italian also. Just now the details of these are guarded carefully, because, in some instances, it is not the composition of the alloy which gives its strength, but the heat treatment which is said to be delicate and elaborate. But what is the laboratory material one day is the commercial the next, and it is as certain as can well be that some amazing new metals will be in use within a short time after peace comes.

Problems Considered at Aircraft Meeting

Specifications and Tests for Dope for Fabrics.
Specifications and Tests for Spar Varnish.
Specifications and Tests for Glue Drawn Up.
Engine Weight Specifications Recommended.
Aircraft Screws, Bolts and Thread Standards.
Tachometer Drive Design Settled.

By P. M. Heldt

ALTHOUGH the meeting of the Aviation Division of the S. A. E. Standards Committee at Washington on Sunday and Monday of this week did not fully accomplish the object set for it, viz., winding up a lot of the work that had been under way, much progress was made along several lines, and at another meeting to be held in a fortnight it is confidently expected to take final action on many items. The difficult problem is to get a sufficient number of men on the different subcommittees and men in the aircraft business generally to attend. Almost everybody engaged in a business having anything to do with aircraft is just now exceedingly busy and many feel that they cannot afford the time to attend committee meetings. Many proposed standards discussed at the meeting could have been definitely adopted had it not been for the fact that when they were taken up there was no quorum present. Two of the subjects discussed—dopes and varnishes—were entirely new so far as standardization is concerned, and while elaborate specifications of properties and tests were drawn up, it was felt that before the committee acted upon them all manufacturers interested should be given an opportunity to criticise them. It was made very clear, however, that only constructive criticism was wanted. It would be of no use whatever to condemn the proposals either in whole or in part; if any one had any fault to find he should make a definite proposal for remedying it. In fact, it was suggested that those desiring any recommendation to be modified submit the paragraph of the report in which it occurred reconstructed in accordance with their ideas.

Coffin's Address

The meeting was called to order by General Manager Clarkson, who said that the object was to take action on data which had been collected on several subjects. The different subjects would almost immediately be referred to subcommittees which already had been working on them. These subcommittees would go into session and would then report to the division.

Howard E. Coffin, chairman of the Aircraft Production Board, made a brief address. He said that all manufacturers of aircraft and of materials therefor were exceedingly busy, and it had therefore been very difficult to get action on many things which should have the attention of men in the industry. If the war were to end in a few months this might be the proper mental attitude, but it was very clear that it would be a matter of years. The establishment of standards, not only for this country but for international use, would eventually largely determine the scale of production of aircraft. At the present time this country has to furnish aircraft material to the Allies. No one will question that the airplane is to play an important part in deciding the war. The belief is rapidly growing that the domination of the air will be the decisive factor. By "domination of the air," Mr. Coffin said, he meant not only predominance along the fighting line but in the use of long-distance bombing machines. There seems to be no limit to what can be accomplished in the way of aircraft. A good example was furnished in a flying boat recently exhibited which had engines of from 400 to 500 hp. and had all the seaworthiness of a yacht. It can travel through the water at from 36 to 38 m.p.h. and can rise from the water and travel through the air at 90 m.p.h. This makes us stop and think what the limit is. From present outlook the use of the flying boat is probably the most effective counter move to the submarine campaign.

For reasons of defense it is not possible to outline the full program of aircraft construction. It is becoming evident already that the present plans will have to be modified and enlarged. There are some materials which cannot be obtained in sufficient quantities, and the question of substitutes will have to be faced.

International Standards

Mr. Coffin said that they were all very busy and many could not see the necessity of coming to Washington and sitting on committees trying to standardize, say, the specifications of aircraft steels. However, in six months' time such standardization will begin to count in production. Besides, in the aircraft art we will see for the first time standards recognized not only in a single country but in several of the leading industrial countries. Members of the S. A. E. have been co-operating for weeks with representatives of the Allies' aerial forces in the International Committee on Aircraft Standardization, of which F. J. Diffin is chairman. This effort at international standardization is meeting with a cordial reception abroad. The allied countries feel that they are dependent on the United States for aircraft materials Speed of action is the chief essential in the present situation. There is also going to be a tremendous demand for parts for airplanes put together abroad. This phase of the subject will depend somewhat on developments in the shipping situation.

At the conclusion of Mr. Coffin's address subcommittees went into session, and some of them continued their deliberations until late in the afternoon, except for an hour for lunch, which was taken at the Bureau of Standards. The subjects under consideration by the different subcommittees were as follows: Spark plug shell; dope; propeller shaft end and hub fittings; varnish; glue; pipe fittings (fuel, oil, air); radiator and jacket connection hose; engine weight specifications; pontoon fittings; safety belts; screws and bolts (eye bolts, fine threads, small and large diameter); tachometer connections; washers (plain, lock and bevel); wheels (hubs, spokes, rims and tires); tension wires, solid and stream line.

To facilitate the transcription of the records a Stenotype machine was used in taking down the proceedings, and outside the meeting room two typewriters were busy transcribing the notes. Late in the afternoon the subcommittee re-

ports were taken to a mimeograph office to prepare copies for distribution among the members at Monday's meeting.

Monday's Meeting

The first report to be made at Monday's session was that on magneto dimensions, by A. D. T. Libby. It was simply recommended that the depth of the dowel pin hole be changed from ½ in. to 5/16 in. and that the width of the magneto space be increased from 5 in. to 6½ in. (165 mm.).

Next the report of the Varnish Committee was read by Percy H. Walker of the Bureau of Standards. Following are some of the recommendations made for varnish specifications:

Varnish Specifications

"The material shall be the best long oil varnish, resistant to air, light and water. The manufacturer is given the greatest latitude in the selection of raw materials and process of manufacture in order to produce a product of the highest quality.

"The material shall comply with the following requirements: It shall be clear and transparent. Its color shall be no darker than a standard color solution made by dissolving 6 g. of pure powdered potassium bichromate in 100 cc. of pure concentrated sulphuric acid (specific gravity 1.84). Gentle heat may be used, if necessary, to secure a perfect solution of the bichromate. The color comparison will be made by placing the varnish and the standard color solution in clear, thin-walled glass tubes of the same diameter, 1.5 to 2 cm. (⅝ to 13/16 in.) to a depth of at least 2.5 cm. (1 in.) and comparing the colors by looking through the tubes across the column of the liquid by transmitted light. It shall not flash below 35 deg. C. (95 deg. F.) in an open tester.

"When flowed on a glass plate held in a vertical position and maintained at a temperature of 21 deg. to 32 deg. C. (70 deg. to 90 deg. F.) it shall set to touch at a point not less than 2.5 cm. (1 in.) from the side or top edges of the film, in not more than 5 hours; and shall dry hard in not more than 24 hours to a clear, hard, glossy and elastic film.

"A coat of varnish will be flowed onto either black iron or tinplate coated with a good quality of good baking japan, allowing to dry 48 hours in a vertical position and then immersing in boiling water for one hour. The water will be siphoned through a small glass tube directly from a container in which it is boiling, onto the surface of the panel, in such a manner that there will be no appreciable lowering of the temperature of the water before it touches the varnish film. The siphon delivery tube will be in a plane nearly parallel to the plane of the panel, so that the impact of the water will not tend to break the film. The varnish shall show no appreciable whitening and no more than a very slight dulling.

Flexibility Test

"The varnish shall be flowed on one side of a piece of terne plate 10 by 15 cm. (4 in. by 6 in.), which has been previously thoroughly cleaned with benzol. The coating must extend entirely across the width of the plate and for at least 14 cm. (5½ in.) of the length. The plate shall then be held in a vertical position for 6 hours at room temperature (21 deg. C. to 32 deg. C.) (70 deg. to 90 deg. F.). It shall then be placed in an oven at a temperature not less than 135 deg. C. (275 deg. F.) or more than 149 deg. C. (300 deg. F.) for 17 hours. It will then be removed from the oven, kept at a temperature between 21 deg. C. (70 deg. F.) and 32 deg. C. (90 deg. F.) for not less than 6 nor more than 24 hours. The panel with the varnished side on the outside will then be rapidly bent double over a rod 3 mm. (⅛ in.) in diameter at a point not less than 5 cm. (2 in.) or more than 7.5 cm. (3 in.) from the bottom of the plate. The varnish film shall show no cracking or flaking at the point of bending.

Endurance Test

"The varnish will be applied in three coats to two unfilled panels of maple wood. Each coat will be allowed to dry indoors for 3 days and will then be lightly sandpapered before the application of the next coat. The final coat will not be sandpapered or rubbed, and the duplicate panels will be exposed outdoors, 45 deg. to the vertical, facing south, 3 days after the application of the finishing coat. The backs and edges of the panels will also be varnished with the same sample, but for these surfaces the details of the method of application as given need not be adhered to, and the effects of exposure on these surfaces will not be considered. On this test the varnish shall show satisfactory durability and weather resisting properties. In cases where the award of a contract cannot be delayed for the results of the exposure test, award may be made on the basis of the other requirements; but a varnish of any specific brand which does not show up satisfactorily on an exposure test may be omitted from consideration in future awards, and a preliminary submittal of samples for making exposure tests may be called for."

In the discussion it was brought out that this varnish is intended for application to both the spars and the wings, in the latter case as a protection for the dope. The above specifications are in the nature of recommendations only, but it is hoped to get action on them at the next meeting. Some discussion ensued as to the best place to make the tests—at the varnish factory or at the customer's plant. It was agreed that if the varnish could be shipped under seal it would be preferable to make the test at the varnish plant, especially if it should be found necessary to reject large quantities. Mr. Walker in this connection explained the Government's system for testing cement. It is tested at the factory and is kept in sealed bins, from which any department of the Government can withdraw cement. A representative of a large varnish firm said that varnish was usually made by them in quantities of 3500 gal., and that to him the plan to take a sample of this lot for test, say under Government supervision, and ship the varnish in sealed containers seemed perfectly practical.

Color Varnish

Mr. Payne, a representative of the British Government, said that experience had taught them that it was best to have a pigment varnish or color varnish on top of the spars, as light affects the cellulose acetate dope. The paint is really a protector for the dope. A suggestion was made that the recommendations of the committee should include a formula for solvents for removing the varnish. In regard to the durability test Mr. Manly pointed out that primary training machines have so many rough landings that it is advisable at the end of 60 days to tear off the fabric and examine the spars and wires beneath, so a much longer life is of no advantage.

Dopes

The report of the subcommittee on dopes was read by W. H. Smith of the Bureau of Standards. The committee recommended that two coats of acetate dope be substituted for spar varnish on training machines. The temperature of the doping rooms of airplane factories should be maintained at 70 deg. F. The airplane manufacturers should store the dope under a roof.

Dope Specifications

Dopes for airplane fabrics must consist of a clear, uniform mixture of ingredients and be capable of shrinking the fabric to the degree of tautness desired by the signal corps inspection. The residual film should give a smooth, homogeneous surface when applied in a horizontal position in an atmosphere not exceeding 65 deg. humidity and 75 deg. F. temperature, free from direct draft. Besides celluloid acetate there are nitrated dopes and the above requirements apply also to the latter.

The viscosity of the dope must permit of direct application without dilution at a temperature not lower than 60 deg. F. (Applies also to nitrate dopes.)

The dope, when dry, must adhere to the fabric with sufficient tenacity to prevent peeling off in sheets. Test strips should show lint attached to the side which has been in contact with the fabric. (This specification applies also to nitrate dopes.)

Four coats, or an equivalent of the dope, 48 hours after application, must increase the tensile strength of linen fabrics not less than 25 per cent of the original strength, and of cotton fabrics not less than 15 per cent. The increase in weight per square yard of doped fabric should not be less

than 2 oz. nor greater than 3.5 oz. The test shall be made under standard conditions of humidity and temperature. (Applies also to nitrate dopes.)

No mineral acids may be present in the dope, and the amount of free organic acidity figured as acetic acid may not exceed 0.2 per cent. No compounds may be present which would be injurious to the fabric. (Also holds for nitrate dopes.)

Dopes which show the presence of free sulphuric acid or sulphates by the test given below are not acceptable. (Omitted in specification for nitrate dopes.)

Dopes containing tetrachlorethane are not acceptable. (Omitted for nitrate dopes.)

The cellulose acetate used should be neutral and stable and completely soluble in acetone. The amount of cellulose acetate should be not less than 60 grams per liter.

Exposure Test

The volatile solvents employed should present no danger to the workmen applying them. (Applies also to nitrate dopes.)

Five drops of gasoline dropped on the film which has been dried for 48 hours and immediately ignited should have no more serious effect than to char the fabric under the moistened section of the film. (Omitted from specification for nitrate dopes.)

Dopes must comply with the following test: A square frame, 12 in. by 12 in, inside measurement, is covered on both sides with fabric, the fabric being tacked to the outer side of the frame. The fabric is to be tacked under uniform tension, simulating that employed in airplane manufacture. Four coats or an equivalent of dope are to be applied to each side of the frame, each coat being allowed thoroughly to dry before the succeeding coat is applied. The frames are to be exposed on a roof in an unshaded horizontal position. After 60 days of constant exposure no spontaneous cracking of the doped surface should be apparent, and after one hour at a temperature of 70 deg. to 80 deg. F. the film shall not crack and shall have a decided ring. This test shall be made comparatively with a dope that has previously passed the test. (Applies also to nitrate dopes.)

Dope shall be shipped in metal cans, metal or wooden barrels or earthenware containers. Inspection of the containers shall be permitted to insure against the introduction of foreign material. The container shall be marked with the date of manufacture, serial number, gross tare and net weight. (Applies also to nitrate dopes.)

Filtration Test

A 500-cc. beaker, containing about 200 cc. of water, is counterbalanced on a large balance. The balance is adjusted to one-hundredth gram by adding or removing water. About 10 grams of dope are poured into the water and the increase in weight noted. This is rapidly done to 0.01 gram to diminish solvent loss. The dope is stirred up and allowed to stand 10 to 15 minutes with occasional stirring. The liquid is decanted through a rather porous filter into an 800-cc. beaker and 150 cc. of warm water added to the residue. It is allowed to stand 10 to 15 minutes with frequent stirring and poured through the filter into the 800-cc. beaker. The residue is washed with 150 cc. of warm water as before. A few drops of phenolphthalein are added and the solution titrated with tenth-normal caustic soda to a color that persists for one-half minute.

Some dopes, notably those containing much acetone, when poured into water precipitate as a milky solution containing shreds of the acetate. The resulting liquor filters slowly and passes through the filter paper in a cloudy condition. Since the acetate is finely divided, it is practically free from acetic acid and additional washing is unnecessary. The end-point is not quite as sharp as when all the acetate has been removed, owing to hydrolysis of the suspended material, but is sufficiently accurate for all practical purposes. Absence of mineral acids must be proved by qualitative tests.

Sulphate Test

Twenty grams of cellulose acetate are allowed to remain at the temperature of the steam bath for 24 hours. The resulting liquor is filtered and tested for sulphates. (Omitted from specification for nitrate dopes.)

Pour 100 grams of the dope into 300 grams of 95 per cent alcohol, stirring constantly. Filter the precipitate on a Buchner funnel and dry at room temperature. Extract in a soxhlet with ether until all extractive material has been removed and dry at 60 deg. C. to constant weight.

Pour some of the dope on a glass plate and allow to dry spontaneously. The film may be examined for the general characteristics of transparency, coherence, strength and flexibility.

Mr. Manly said he appreciated the warning contained in the specifications that dope must be kept under roof, for at his plant they had allowed twenty-five barrels of the material to remain outside. The point was brought out that the navy puts color varnish over the dope to prevent the effect of sun rays. All dopes seem to stand up well when left in the dark. Some difficulty was hinted at as unavoidable when trying to put a coat of color varnish over dope as it will become streaky. Constructive criticism on this report is asked for and action is expected on it at the next meeting.

The sub-committee on pontoon fittings, after reconsidering its two previous reports, voted that these details were not in form for standardization at the present time and that it was the sense of the meeting that every effort of those present should be made toward trying out different kinds of handholes, etc., with a view at the earliest possible future date to again consider what would be the best practice for standardization.

John R. Cautley read the report of the engine weight specifications sub-committee. Although not acted on at this meeting it was quite likely that the report will be accepted as read.

This report also includes blanks for filling in the weights of all engine accessories, make of same and whether this weight is included in the engine weight or not.

Spark Plug Shell

O. C. Rohde made the report for the spark plug shell subcommittee. Investigation seems to show that a 1-in. hex is nearest to foreign standard. Further information is being sought on the Italian standard. If a 1-in. hex proves to be approximately the foreign standard, it will be recommended for aeroplane plugs. If the 1-in. hex is not found to agree with the foreign standards, some size now in use, preferably 15/16 in., will be recommended for adoption. In case a 1-in. hex is adopted and 1.025 in. is found to represent foreign practice, a spark plug wrench with a minimum dimension of 1 1/32 in. is recommended.

Where threads are chased, a flange 3/64 in. thick and .003 in. larger in diameter than the outside thread diameter is recommended, the neck to be .625 in. diameter by 5/64 in.

Engine Weight Specifications

Manufacturer .....
Model .....
Bore .....in. .....mm. Stroke .....in. .....mm.
No. of cyl. ..... Type .....
Piston displacement .....cu. in. .....liters
Compression ratio.....
Horsepower ..... at .....R.P.M. (H.P. Computed at standard barometric pressure 29.92 in. (76 cm.) 32 deg. F. (0°C) 45°.
Gasoline Consumption .....lbs. .....kilos. per hour at above H.P.
Oil Consumption .....lbs. .....kilos. per hour at above H.P.
Propeller speed .....R.P.M. at above engine speed.
Weight of engine .....lbs. .....kilos.

The weight of engine includes the following parts:
1—Ignition (service magneto and wire supports or battery ignition distributor and coils and wire supports).
2—Generator (if used) with cut out, etc., and ammeter.
6—Carbureters.
7—Inlet pipes.
Above numbers refer to parts given in the schedule.
Comparison of standard water-cooled engines with rotaries and fixed air-cooled types may be made by means of attached schedule of weight.

S. A. E. Airplane Bolt Thread Standard

(All Threads to be of the U. S. Form)

Diameter	Threads per In.	Diameter	Threads per In.	Diameter	Threads per In.
No. 4 (.112)	36	No. 12 (.216)	32	7/16	20
No. 6 (.138)	32	1/4	28	1/2	20
No. 8 (.164)	32	5/16	24	9/16	18
No. 10 (.190)	32	3/8	24	5/8	18

S. A. E. Airplane Fine Thread Standard

(All Threads to be of the U. S. Form)

Diameter	Threads per In.	Diameter	Threads per In.	Diameter	Threads per In.
1/4	40	1	20	3	16
5/16	36	1 1/8	18	3 1/4	16
3/8	32	1 1/4	18	3 1/2	16
7/16	28	1 3/8	18	3 3/4	16
1/2	26	1 1/2	18	4	16
9/16	24	1 5/8	16	4 1/4	16
5/8	24	1 3/4	16	4 1/2	16
11/16	22	1 7/8	16	4 3/4	16
3/4	22	2	16	5	16
13/16	22	2 1/4	16	5 1/4	16
7/8	20	2 1/2	16	5 1/2	16
15/16	20	2 3/4	16	5 3/4	16
				6	16

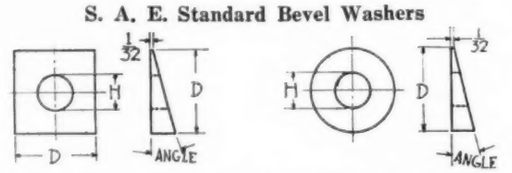
S. A. E. Airplane Bolts

(Dimensions refer to drawing of bolts as adopted)

Size "A"	No. 4	No. 6	No. 8	No. 10	No. 12	1/4
Thds. per in	36	32	32	32	32	28
Limits "A"	.108	.134	.160	.186	.212	.246
	.112	.138	.164	.190	.216	.250
Head Diam. "B"	1/4	5/16	5/16	3/8	3/8	7/16
Head Height "M"	3/32	7/32	7/64	1/8	9/64	9/32

Size "A"		5/16	3/8	7/16	1/2
Thds. per in		24	24	20	20
Limits "A"		.308	.371	.433	.496
		.312	.375	.437	.500
Head Diam. "B"		1/2	9/16	11/16	3/4
Head Height "M"		5/16	7/32	1/4	9/32

S. A. E. Standard Bevel Washers



At left is shown square washer and on right, round washer

Values of angle are 6, 12, 24, 36 degrees for all sizes

Bolt Size	H	D
No. 4	No. 32 (.116)	3/8
No. 6	No. 27 (.144)	7/16
No. 8	No. 18 (.169)	1 5/32
No. 10	No. 10 (.193)	1/2
No. 12	No. 2 (.221)	9/16
1/4	17/64	5/8
5/16	21/64	11/16
3/8	25/64	3/4
7/16	29/64	13/16
1/2	33/64	1

S. A. E. Standard Bevel Washers

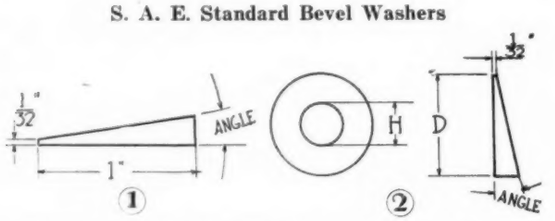
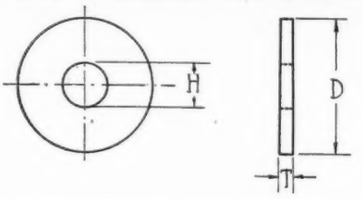


Figure 1 shows stock from which washers will be made
Figure 2 shows finished washer

Values of angle are 6, 12, 24, 36 degrees for all sizes

Bolt Size	H	D
No. 4	No. 32 (.116)	3/8
No. 6	No. 27 (.144)	7/16
No. 8	No. 18 (.169)	1 5/32
No. 10	No. 10 (.193)	1/2
No. 12	No. 2 (.221)	9/16
1/4	17/64	5/8
5/16	21/64	11/16
3/8	25/64	3/4
7/16	29/64	13/16
1/2	33/64	1

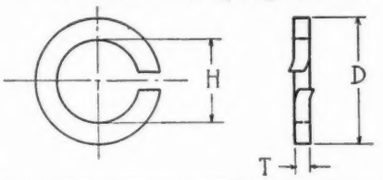
S. A. E. Standard Plain Washers



Bolt Size	H	D	T
No. 4 (.112)	No. 32 (.116)	3/8	.035 (No. 20 B. W. G.)
No. 6 (.138)	No. 27 (.144)	7/16	.035 (No. 20 B. W. G.)
No. 8 (.164)	No. 18 (.169)	1 5/32	.035 (No. 20 B. W. G.)
No. 10 (.190)	No. 10 (.193)	1/2	.035 (No. 20 B. W. G.)
No. 12 (.216)	No. 2 (.221)	9/16	.049 (No. 18 B. W. G.)
1/4	17/64	5/8	.049 (No. 18 B. W. G.)
5/16	21/64	11/16	.049 (No. 18 B. W. G.)
3/8	25/64	3/4	.049 (No. 18 B. W. G.)
7/16	29/64	13/16	1/16
1/2	33/64	1	1/16
9/16	19/32	1 3/16	5/64
5/8	21 1/32	1 1/4	5/64
11/16	23/32	1 5/16	5/64
3/4	25/32	1 7/16	3/32
7/8	29/32	1 5/8	3/32
1	1 1/32	1 7/8	3/32

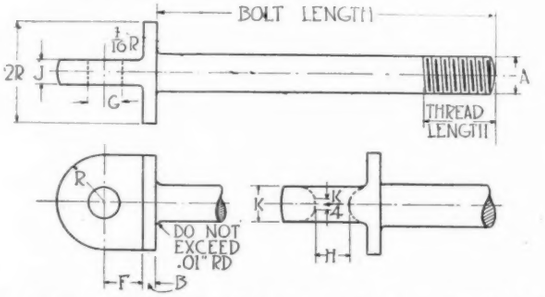
Numbers in "H" column are number size drills.

S. A. E. Standard Spring Washers



Bolt Size	Hole Clearance	H	Section	D
No. 4	1/64	.128	1/32 x 1/32	.190
No. 6	1/64	.154	3/64 x 1/32	.247
No. 8	1/64	.180	1/16 x 3/64	.305
No. 10	1/64	.206	5/32 x 3/64	.393
No. 12	1/64	.232	1/8 x 3/64	.482
1/4	1/64	17/64	1/8 x 1/16	33/64
5/16	1/64	21/64	1/8 x 1/16	37/64
3/8	1/64	25/64	1/8 x 1/16	41/64
7/16	1/32	1 1/32	5/32 x 1/16	2 5/32
1/2	1/32	1 3/32	5/32 x 1/16	2 7/32
9/16	1/32	1 9/32	3/16 x 1/16	3 1/32
5/8	1/32	2 1/32	3/16 x 3/32	1 1/32
11/16	1/32	2 5/32	3/16 x 3/32	1 3/32
3/4	1/32	2 9/32	3/16 x 3/32	1 5/32
7/8	1/32	2 9/32	1/4 x 3/32	1 11/32
1	1/32	1 1/32	5/16 x 1/8	1 21/32

S. A. E. Standard Airplane Eye Bolts



Bolt lengths and thread lengths same as S. A. E. Standard Hex. Head Bolts

Bolt end shown above is to be used only when taking wires or cables directly

S.A.E. Nos.	Strength in Pounds	Diam. "A"	Hole Size "G"	Hole Size "H"	Dimension "R"	Dimension "F"	Dimension "B"	Dimension "J"	Dimension "K"
1	500	No. 12	5/16	5/32	5/16	3/8	3/32	1/16	1/8
2	1000	No. 12	5/16	5/32	5/16	3/8	3/32	1/16	1/8
3	1500	No. 12	5/16	5/16	5/16	7/32	1/16	1/16	5/16
4	2000	1/4	5/16	13/64	3/8	7/16	1/8	5/32	5/16
5	2500	5/16	1/4	15/64	3/8	1/2	1/8	5/32	7/32
6	3000	5/16	1/4	19/64	7/16	1/2	1/8	5/32	7/32
7	3500	3/8	1/4	19/64	3/8	17/32	5/32	5/16	1/4
8	4000	3/8	9/32	19/64	15/32	17/32	5/32	5/16	1/4
9	4500	3/8	9/32	21/64	15/32	17/32	5/32	5/16	9/32
10	5000	3/8	9/32	21/64	15/32	9/16	5/32	1/4	9/32
11	6000	7/16	5/16	23/64	15/32	9/16	5/16	1/4	5/16
12	7000	7/16	5/16	23/64	17/32	9/16	5/16	1/4	5/16
13	8000	1/2	5/16	25/64	17/32	19/32	7/32	5/16	11/32
14	9000	1/2	3/8	25/64	9/16	19/32	7/32	5/16	11/32
15	10000	9/16	3/8	29/64	9/16	21/32	7/32	5/16	3/8

thick. Where threads are rolled they may be run to the shoulder.

It is recommended that 3/32 in. be the minimum dimension from the bottom of the thread chamfer to the bottom of the shell.

Safety Belts

No definite recommendations were made by the sub-committee on safety belts, but M. Hunsaker had procured a sample of English manufacture which was exhibited at the meeting. This consists of two pieces of elastic webbing about 7 in. wide laced at the back with cotton lacing and secured together in front by a buckle clasp. This was said to be satisfactory to the army. The navy was said to be using a somewhat different design. Capt. Chauvalon thought that the lacing might better be of rawhide and that he would prefer elastic webbing in the fastening straps. Mr. Riddell submitted a belt and safety catch as used by the Canadian air forces. It was suggested to submit Mr. Hunsaker's sample to the navy and ask them whether it would not meet their requirements.

Wheel Rims

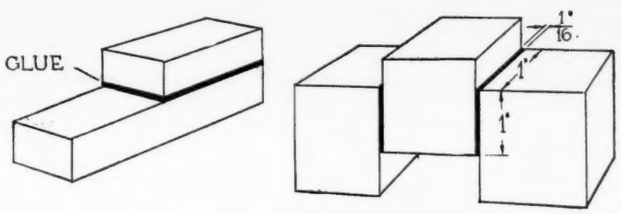
J. E. Hale presented a progress report for the sub-committee on rims and wheels. It has been decided to make the rims of .093 in. stock containing .010 to .020 per cent carbon. Mr. Manly thought this was of insufficient strength. His own experience has shown that the weakest point of the wheel was in the rim, owing to the nipple holes in the rim. His firm had recently declined a shipment of rims made of steel containing about 18 points carbon. In a certain compression test a rim made of 26 point carbon steel withstood a pressure of 15,000 lb., while rims made of the lower carbon steel gave way at 10,000 lb. In reply Mr. Hale said that the 10-20 point carbon steel had been recommended because the rim makers considered it a safe and sane material. With higher carbon there were many failures, especially in cupping for the spoke heads. He asked Mr. Manly whether he had ever experienced a failure of a wheel due to a weak rim. To this Mr. Manly replied he had seen failures of wheels occur while the airplane was running over rough ground. First some spokes would loosen and then the load would be unevenly distributed and the wheel would fail. Mr. Manly also told of a case where one concern rolled the rims of medium carbon stock and another punched the nipple depressions. A great many rims were lost due to splitting of the material at the nipple holes. This trouble was eliminated by bestowing more care on the punching operation, working more slowly.

E. H. Ehrman presented the report for the screw and nut sub-committee. This report covered airplane bolt threads, fine threads, spring washers, plain washers, bevel washers and eye bolts and the recommendations are embodied in the tables and diagrams on the opposite page.

Tests of Glue

A subcommittee on glues made a report containing specifications for all glue used for propeller construction and for splices of important structural members such as longerons and beams.

The glue must be a high-grade hide glue, sweet and free from any deleterious substances. The glue shall be compared to a standard sample for adhesiveness, jelly strength, viscosity, grease and foam. The standard sample may be obtained from the director of the Forest Products Laboratory, Madison, Wis., or may be a sample of a glue which has been satisfactorily used in propeller construction and certified to by the authorized glue expert of the purchaser.



Test pieces referred to in glue report

Tests on glue shall include tests made at the glue factory and tests made at the airplane factory. Tests at the glue factory are to insure a proper quality and certification of this quality. These tests shall be made by comparing the run of glue with the standard sample.

The bidder may compare his glue with the standard sample by any methods he desires. The tests by the purchaser, however, will be made as follows:

The strength test will be made by gluing together two pieces of yellow birch 1 in. thick, having a shearing strength of at least 2200 lb. per square inch. This will require birch having an air-dry weight of about 50 lb. or more per cubic foot, and a moisture content of from 8 to 12 per cent. These should be tested by shearing them in a testing machine. The glue will be mixed in proportion recommended by the glue manufacturer. It will then be melted in a water bath and applied to the wood at a temperature of about 60 deg. C. (140 deg. F.). After gluing the test blocks will be held in clamps for 24 hr., then removed from the clamps and allowed to stand for six additional days. They will then be finished so that the blocks when ready to test will have a glued joint 2 in. square and will be of the shape shown in the sketch. When tested in this way no test block shall fail under a load of less than 2200 lb. per square inch.

The jelly strength will be determined upon a mixture containing 12 parts of water to 1 part of glue. The glue will be soaked and melted as described under "Adhesiveness," then allowed to stand over night in a refrigerator at a temperature of 5 to 10 deg. C. (40 to 50 deg. F.). The relative strength of the standard sample and the bidder's sample will then be determined by pressure with the fingers immediately after the samples are removed from the refrigerator.

Viscosity Test of Glue

The viscosity will be determined in an Engler viscosimeter upon a sample containing 1 part of glue to 5 parts of water, soaked and melted as described under "Adhesiveness." Two hundred cubic centimeters of the glue mixture will be run through the viscosimeter at a temperature of 60 deg. C. (140 deg. F.).

The relative amount of grease present will be determined by mixing dye with some of the sample remaining from the viscosity test, painting it on unsized white paper and observing the grease spots.

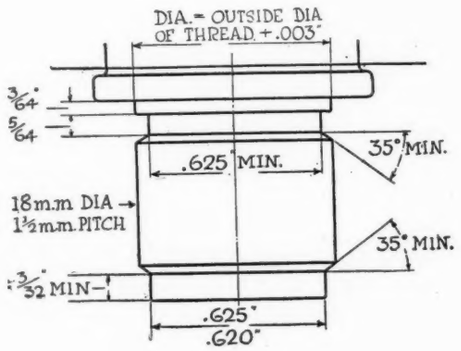
The foam will be tested on the sample used for viscosity. The sample heated to 60 deg. C. will be beaten for one minute with a power egg beater or similar instrument, and allowed to stand one minute, or until the height of foam can be measured.

The odor of the glue when in the hot solution must be sweet and must remain sweet for 48 hr.; that is, free from any suggestion of deteriorating animal matter.

Glue Tests at Airplane Factory

Tests made at the airplane factory are to determine the strength of the glue joints under the average conditions prevailing in the glue room. Tests shall be made on representative woods used by the manufacturer concerned. The glue test specimen shall be made of three boards ¾ in. to

(*Continued on page* 612)



Spark plug shell

Signal Corps' Heavy Truck Details

Assembled Vehicle Built Specially by Kelly-Springfield Taken as Model

IN the last issue of AUTOMOTIVE INDUSTRIES specifications were given for the light assembled truck which will be used by the Signal Corps, and it was then stated that the heavy specifications were almost ready. From the details given below it will be seen that there is a close similarity between the light and heavy models in general type. As in the case of the light truck now being made by the General Motors Truck Co., this heavy model which Kelly-Springfield is making could be built by any chassis assembler.

Trailer designs are now being debated, and it appears most probable that a two wheel type will be accepted very shortly. It is intended to supply a trailer for nearly every truck.

A. General Provisions

1. These specifications are drawn to cover the general requirements of the Signal Corps in all purchases of heavy aviation trucks, type "S," as manufactured by Kelly-Springfield Motor Truck Company.
2. All trucks and parts thereof must conform to the requirements of the respective specifications issued by the Signal Corps and applying thereto at the date of the contract.
3. The buyer will furnish the seller with a complete set of construction drawings, together with necessary detail drawings of special parts.
4. All deviation from specification requirements and changes in design or detail shall be authorized only by the Equipment Division of the Signal Corps on official notices delivered to the seller by the Production Section of the Signal Corps.

B. Materials

5. All materials entering into the construction of these trucks shall conform to the general specific requirements of the specifications relating thereto, and shall be subject to inspection by the Inspection Section of the Signal Corps; provided, that approved modifications may be made in accordance with paragraph 4.
6. The seller shall, upon request, furnish the buyer or his authorized representative the names of any or all manufacturers furnishing him with materials, parts, or accessories, whether finished or unfinished. He shall also furnish the Government Inspectors with records of all the chemical, physical and other tests upon request.

7. The Following Parts Shall Be As Specified Below

ENGINE — (a) Continental, Type E-4 Special, with pressed steel rear mounting. Four cylinders, 4½" x 5½". Fan, 20" diameter, 2" flat belt. Governor, Pierce Centrifugal Type with bevel drive. Carburetor, Stromberg M-2, 1¼". Sectional sod pan, between engine and frame. Magneto, Eisemann G-4, waterproof, fixed spark.

RADIATOR—(b) Pressed steel tank, bolted type, with core of vertical spiral tubular type. ⅜" tubes.

STEERING GEAR—(c) Gemmer worm and wheel type, Model R.

CONTROL — (d) Steering column and pedals located on left side of chassis, with Brown-Lipe, Model 60 control set mounted at center. Carburetor control on dash, two positions start and run. Pedal accelerator.

CLUTCH—(e) Brown Lipe, Model 60, multiple disc attached to bell housing on engine.

TRANSMISSION—(f) Brown-Lipe, Model 60, four speed and reverse mounted amidships on chassis.

UNIVERSAL JOINTS AND SHAFTS—(g) Spicer 500 Series, forward and rear shafts interchangeable, except for companion flanges.

FRONT AXLE—(h) Timken No. 1630 B, with 5" drop.

REAR AXLE—(i) Timken-David Brown worm Type No. 6652.

RADIUS RODS—(j) "I" Section with Universal connection at rear axle.

SPRINGS—(k) Semi-elliptic, chrome vanadium—Perfection or Mather.

FRONT AND REAR WHEELS—(l) Artillery Type S. A. E. Standard.

TIRES—(m) 36 x 5 front and 36 x 5 dual or 36 x 10 single rear, pressed on type.

FRAME—(n) Pressed steel channel straight-side rails 38" wide, 7" x 3½" x ¼" at largest section.

GASOLINE TANK—(o) Steel gasoline tank with approximately 30 gallons capacity, located under cowl of dash.

FENDERS—(p) One piece heavy pressed steel, rigidly braced.

DRIVER'S SEAT—(q) Pressed steel with fore doors. Seat to carry three men in addition to driver.

TOP OVER SEAT—(r) Four Post Canopy, front, side and rear curtains.

EQUIPMENT—(s) Two Adams & Westlake oil side lamps and one tail lamp, complete set of small tools in kit, 5-ton screw jack, warning signal, hub odometer, front and rear bumper, radiator guard, towing hooks on all four corners of frame, spring drawbar attachment with artillery pintel hood at center of rear frame.

PAINTING—(t) Chassis finished in olive drab priming coat.

C. Load Capacity

8. The normal load capacity of this truck shall be 6000 lbs. in addition to the weight of standard class B, Quartermaster Body.

D. Correspondence

9. Communications regarding this specification should be addressed to the Specification Section, Signal Corps, U. S. Army, Washington, D. C.

GEORGE O. SQUIER,
Brigadier General, Chief Signal Officer.

Specialization: Objectionable Effects and a Possible Remedy

IN his presidential address, read before the Institute of Electrical Engineers, retiring president H. W. Buck said that the engineering profession had passed through the preliminary stages of its growth and had reached a position where the engineer should work and act not only with proper attention to his work itself, but with full consciousness of the important relation of his work to human affairs in general. Among the early pioneers in engineering were many notable instances of men of great breadth of view—men like Watt, Fulton, Whitney, McCormick, Ericsson and others. Specialization had not at that time begun to work its narrowing influences. Of recent years, however, under the stress of commercial development and economic conditions, increasing specialization has taken place and the engineer has become obliged to compass his mind with an ever-narrowing horizon. This specialization produces extraordinary proficiency in particular fields, but has the objectionable effect of narrowing the character and outlook of the man and of reducing his value as a citizen. We must take care lest commercial considerations and the modern mania for efficiency in the narrow sense force our engineers to lose sight of the world around them in their concentrated attention to the part rather than to the whole. This excessive specialization is a danger which threatens the future standing of the engineer.

It is interesting to recall in this connection the results of a recent canvass made by a joint committee on education on the qualities which, in the opinion of about 5000 leading men, engineers and others, best fit a man for a successful career as an engineer. As a result of this vote only thirteen points out of a hundred were assigned to purely technical knowledge as an essential, the other eighty-seven points being allotted to broader qualifications, such as judgment, character, human understanding, etc. This is merely a quantitative statement of the many general demands now being made of the engineer, and it illustrates how his work has broadened.

A most significant movement of recent times in the engineering world has been the development of co-operative action among engineers of all classes, and this tendency will, I believe, serve to offset the evils of specialization. It is the growing recognition of the fact that all branches of engineering are interdependent.

Motorcycle Standardization Carried Ahead

At a Conference Between Army Officers and Motorcycle Engineers Previous Work in Standardization Is Reviewed and Some New Work Started

At a meeting of the Military Motorcycle Standardization Committee held at the Washington headquarters of the S. A. E. on Tuesday there was a larger representation of the Army than at any of the previous meetings, and the session developed to quite an extent into an interchange of views between Army officers and representatives of the industry. The officers in attendance included Capt. Wm. M. Britton, in charge of motor transport engineering; Capt. F. C. Hicox and Lieut. Colonel U. S. Grant of the general staff, besides whom G. H. Hallock of the First Motor Battery, New York, also attended.

The first subject taken up was that of standardization of spokes and nipples for motorcycle wheels. A standard repair spoke had been settled upon at previous meetings. This is sufficiently long to serve for repairs of all makes of motorcycle wheels now on the market. For the standard wheel to be used in future construction, which is of the 28 by 3 in. size with 40 spokes laced four across, this spoke is too long. Mr. Hanks of the S. A. E. on the previous Saturday had had a conference with Mr. Graham of the Standard Co., Torrington, Conn., in which this matter was gone over. Blueprints showing a tentative design of spoke and nipple were presented for discussion. Mr. Graham was on hand to take part in the discussion, and another spoke manufacturer, the National Screw & Tack Co. of Cleveland, Ohio, was represented by G. W. Money. Every dimension of the proposed spoke was thoroughly discussed and in some cases slight alterations were made and limits set. We hope to be able to print a drawing of the modified design in our next issue.

Considerable discussion developed as to the relative advantages of rolled and cut threads and of the two forms of threads, viz., the Whitworth and the U. S. Standard. The chief differences between the two are that whereas the Whitworth has an angle of thread of 55 deg., the U. S. S. has an angle of thread of 60 deg., and whereas the Whitworth has a rounded crest, the U. S. S. has a square crest. It was stated in the discussion that many threads which appeared to be Whitworth threads were really U. S. S. with the corners of the thread cut or worn round. Inasmuch as there is said to be a movement on foot to discard the Whitworth thread in England, where it originated, it would hardly be advisable to adopt it in this country, and the consensus of opinion of the meeting seemed to be that the U. S. S. thread should be adopted. After a lengthy discussion of the subject from every angle it was decided to specify the pitch and form of thread, the pitch diameter and top diameter, with tolerances, and leave it optional with the manufacturer to either cut or roll the thread.

It was agreed that the total length of the spoke should be 10 9/16 in., that the butt end should be 1½ in. long and the thread 11/16 in. The spokes are to be made from wire having from 0.040 to 0.055 per cent carbon, not under 0.050 per cent manganese, not over 0.005 per cent phosphorus and not over 0.005 per cent sulphur. This material has a tensile strength of 140,000 lb. per sq. in., which for the section of the wire from which the spoke is made gives an ultimate strain of 1580 lb. The wire has a diameter of 0.148 in. with a plus limit of nothing and a minus limit of 0.001 in. In order to obtain wire of this very fine limit an extra price has to be paid, but in the opinion of the makers of spokes the extra cost is money well spent, in view of the saving it permits in shop costs. In addition to the tensile test the wire is to be subjected to a bending test. This consists in bending it over a radius equal to one-half its own diameter, first through a quarter turn in one direction, then back, then through a quarter turn in the opposite direction and then back again. In the opinion of Mr. Graham, if it is possible to obtain wire to satisfy this test, it will not give any trouble in service.

Before deciding on the tolerances for the thread it was decided to find out what tolerances other departments, say the Navy, call for on screws of this size. The nipples are to be made of free cutting screw stock containing from 0.008 to 0.020 per cent carbon. Until quite recently the nipples of wire wheels were made of brass, and there is never any trouble with the nipples due to lack of strength—the trouble comes in cutting the long thread of small diameter.

After the detail of the spoke and nipple for the standard wheel had been fully settled, the standards worked out at previous meetings were passed over and reviewed. In connection with the pipe union for fuel and lubrication lines it was decided that the union nut should be made of steel and copper-and-white-nickel plated.

The tube for which the union is intended is of 5/16 in. outside diameter, and is to be sweated into the male member of the union. Limits of plus and minus 0.001 in. were decided upon for the outside diameter of the hub of the male member, the maximum diameter of same and the bore through the flange of the nut. No change was made in the designs for the headlamp supporting prong and headlamp mounting lug. Some changes were found necessary in tentative figures set down for the dimensions to be allowed for magneto space. These dimensions were agreed upon as follows: Height, 6 in.; length from large end of taper on armature shaft, 6⅛ in.; width, 4 in. over brushes and 3⅛ in. over magnets.

Taking up the subject of the standard C C rim, Messrs. Hedstrom and Herrington were appointed a committee to obtain from the Clincher Tire Rim Association full details regarding the dimensions and tolerances on the 28 by 3 in. size of C C rim, the materials to be used in the manufacture of the rim and tests of the completed rim, and also to prepare a drawing showing all dimensions of the rim and the proper lacing of the spokes.

No changes were deemed necessary in the specifications of spark plug shells, which so far as they have been drawn up are identical with the specifications for spark plug shells for aircraft motors.

The specifications of throttle control, spark control, clutch pedal, brake pedal, gearshift, kick starters, chains, oil and grease cups and tires were adopted without alterations. In connection with the gearshift, however, Capt. Britton pointed out the great importance of standardizing gearshift control positions. While he did not insist upon this being attended to immediately, in view of the very serious difficulties involved, he urged the members of the committee to keep the desirability of standardized gear control constantly in mind. Colonel Grant in this connection voiced the opinion that it would be advantageous to have the low gear position forward, inasmuch as the gear lever is then in a most convenient position for the driver when going at high speeds.

The specification of carrying capacity was changed to read as follows: "The maximum sprung load carrying capacity on military motorcycles and side car shall not exceed 500 lb., including the operator. No load to be strapped or attached to any part of the frame of either the motorcycle or side car, *except that two rifles and boots may be carried on the front fork.*" The words in italics are new matter.

At the conclusion of the meeting Capt. Britton outlined a list of subjects which he considered should have the attention of the committee at future meetings. These are hub design, including bearings, brakes and connections; standardized control, transmission design and bolts and threads.

Views from Third Annual Ontario

1—*On the best day of the demonstration more than 400 cars were parked on the grounds*

2 *and* 3 — *Cleveland tractor drawing a potato planter and a potato digger*

4—*The Never-Slip creeper-type tractor*

Farm Tractor Demonstration

5—*Group photo of a large number of tractors. The work done is more conspicuous in the photo than are the tractors*

6 — *The two-wheeled Universal tractor pulling three bottoms*

7 — *Canadian - built rein - drive tractor at work*

8—*A view among the tents, showing some of the farm machinery exhibited*

French Ambulance System at Front

Must Carry Gasoline for 24 Hours' Running—Clean Machines Used as Guard Against Breakdowns—French Ambulance Designs

By W. F. Bradley
Special correspondent with the Allies on French front for THE AUTOMOBILE AND AUTOMOTIVE INDUSTRIES

A convoy of standardized type Fiat ambulances in French Army service

OFFICIALLY each infantry division of the French army, comprising 16,000 men, has at its disposal one automobile ambulance section, consisting of twenty vehicles. These twenty automobiles are responsible for the removal of wounded men from the regimental first aid stations to either the operating or the general clearing hospital located from 6 to 12 miles in the rear, according to circumstances and general conditions. The work of a sanitary section is intensely variable; there are times when the divisional work could be carried out with ease by a couple of cars, and there are periods when the whole twenty, working at highest pressure, are inadequate to deal with the rush of wounded. Thus, while a section per division is the officially recognized proportion, in times of activity arrangements have to be made for reserve sections to be placed on the attacking front, and for drafts to be drawn from sectors which are quiet and not likely to need ambulance assistance.

Not Under Medical Control

The intensely variable nature of the work necessitates the most careful organization if the wounded are to be adequately attended during periods of great military activity. The utilization has not always been of the best, as is proved by the discussions in official French circles of the manner in which the sanitary service has operated under periods of great stress. There has been discussion as to whether the ambulances should be under the control of the medical staff, or of the automobile officers acting under the direction of the headquarters' officers. The doctors have claimed that automobile officers are sometimes more interested in keeping their cars in good condition than in getting the wounded away quickly, and have inferred that had they (the doctors) had complete control, the number of men carried in any given time would have been increased.

It is obvious, too, that the headquarters staffs have frequently been too much disposed to treat the ambulance service as outsiders who need never be taken into consultation, and who need never be informed until the last moment of pending military operations. When this spirit has prevailed it is evident that the ambulance sections have not been placed to the best advantage, nor, for lack of adequate warning, have they been able to work at maximum efficiency.

Undoubtedly the ambulance service should be in the hands of automobile officers, and not under the direct control of the doctors. The latter have not the experience necessary to get the best results out of a fleet of mechanical vehicles. A medical man can be excused for a display of annoyance at the withdrawal of an automobile during the height of an action, but the automobile officer may know that the withdrawal for a few hours at the opportune moment may mean the saving of a vehicle from complete mechanical destruction, and thus be to the ultimate benefit of the entire service. It is essential, however, to get the best results that the ambulance service be allowed to enjoy the confidence of the general staff in order that their vehicles be adequately prepared for the work about to be thrown on them.

Additional Vehicles

In addition to the 20 ambulances, each sanitary section has attached to it one automobile truck with tools for running repairs, and a capacity for general stores, frequently one automobile trailer on two wheels, a touring car for the use of the lieutenant in charge of the section, and a motorcycle for the despatch rider. The truck and the trailer have a very small mileage, for the former is only used to bring up general stores—gasoline, oil, food, etc.—and to transport the general stores of the section when a change of base is ordered.

An automobile ambulance section on front line work must

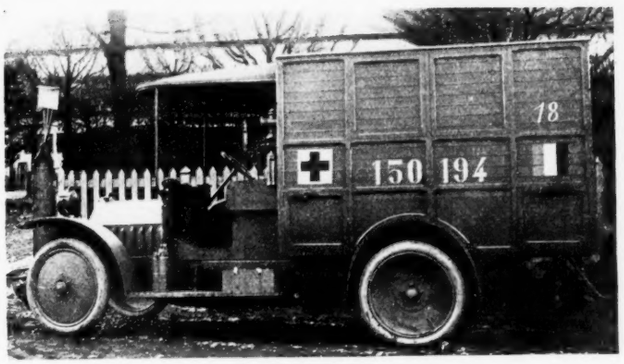
carry its own sleeping quarters, in the shape of light tents, although these are only used when it is impossible to find shelter in permanent buildings. Generally the 46 men in a section—40 drivers, 2 mechanics, 2 cooks, and a couple of officers—can find more or less satisfactory accommodations in wrecked buildings behind the positions they are to work. It is only after an advance into country which has been subjected to a very heavy bombardment that the whole of the mobile equipment has to be brought into use.

Taking an average case, the section will select as its quarters some building or group of buildings. These are immediately disinfected. If there is a kitchen, it is made use of; if not, the cookstove carried on the trailer is placed in some shed or outbuilding. The trailer is permanently placed in position and becomes the mechanics' shop; the touring car and motorcycle are garaged nearby. The main duty of the lieutenant in charge is to keep in touch with the regimental dressing stations from which he will have to evacuate, to transfer his cars, as the action develops, to the points where their services are most required, and to maintain a directing control over the entire organization. The two mechanics are responsible for the mechanical efficiency of the section, and in times of activity must get temporary disabled ambulances on the road again with the least possible delay. Generally they take charge of tires, so that any driver coming in with a puncture or burst finds another wheel with tire mounted awaiting him. The mechanics possess nothing more than a good set of hand tools and practically no other spare parts than bolts, nuts, washers, split pins, etc. They are expected to do running repairs, and not general overhauling.

Ambulance Performances

As an indication of the work which can be done by automobile ambulance the following figures taken from the return sheets of a section seen in operation on the French front are interesting. In a period of 24 hours the 20 ambulances of this section had carried 700 men, or 35 men per car per 24 hours. During a period of 6 consecutive days the 20 ambulances carried 8000 wounded men, or an average of 67 men per car per day. The former figure of 35 men per car per day was during a period of moderate activity; the second figure, 67 men per car per day, represented a maximum attained during a great battle. These two periods represented military activity when stretcher cases as well as sitters had to be carried. Thus, when the greatest effort is required, the number of cases carried per journey is the lowest, for an ambulance which will carry 8 sitters, or 10 in an emergency, cannot accommodate more than 4 stretchers.

Front line work with an army ambulance. Collecting wounded men as they come out of the trenches



Type of standardized Fiat ambulance

The Ford as used by French sanitary service

Taking the first case as normal, the 700 cases represented 500 sitters and 200 stretchers; this represents 113 journeys, or 6 trips per car per day. As the hospital was 8 miles behind the lines, this gave an average of 96 miles per car per day. The greater proportion of this front-line work has to be done over shelled roads and under very heavy traffic conditions, owing to supplies and reserve troops being hurried to the front. To average 35 men and 96 miles per day calls for really serious work on the part of drivers. To carry this average up to 67 men per day, with a corresponding increase in mileage, and maintain this average for six consecutive days, is a task of no small proportions. It is, indeed, very near the limits of endurance of the men and material. French regulations call for two drivers per car, but to get the maximum efficiency during this period of stress only one driver was employed during daylight hours, so that each car was running without interruption for 144 consecutive hours, and the men averaged 16 consecutive hours service per day.

Good French Type

The section from which these returns are taken consisted of Rochet-Schneider touring car chassis with special ambulance bodies. They had gone into service August, 1914, and for three consecutive years had never been away from the front, all their repair work being done by the mobile workshops attached to the armies. While going over the return sheets the major suddenly turned to the lieutenant in charge of the sections and said, "If a hurry-up order came along how many of your 20 ambulances could you send

out right away?" "Nineteen," was the answer, "and the twentieth within 24 hours."

An examination of the section at its quarters a few miles back of the lines proved that its mechanical condition was undoubtedly high. The bodies bore every evidence of hard work and encounters with bits of shrapnel. The paintwork was certainly not of the best, but the interiors were clean and, considered mechanically, the automobiles were in a condition to satisfy the men who draw up lubrication charts and write mechanical hints. It was obvious that the officer in charge insisted first on perfect cleanliness of mechanical parts, so that it was impossible for wear to set up or looseness to develop under a layer of greasy mud, unknown to the driver. Regular and adequate lubrication of all parts not provided for automatically was attended to; minor defects were treated as they developed, the two section mechanics being responsible for their detection; also at regular intervals the vehicles were taken off the road and examined more carefully than it is possible for drivers to do in their daily cleaning.

There is no secret about the methods necessary to keep an army fleet of automobiles in the best condition, for it is the method adopted by all the big automobile transportation companies, with much of the polish and paint cut out. Nevertheless, it is much more difficult to get the same standard on war service as in peaceful civilian duties. Experienced convoy officers will overlook a thick coating of mud on the outside of the underpan, but they have no pity for the driver who lets his ignition wires chafe, who allows his gasoline line to get adrift, who runs his tires under inflated, who allows steering connections to be coated in mud and go ungreased, who has loose hose connections, or who does not report a leak in the radiator.

Controlling the Fuel

Gasoline and oil supplies are in the hands of the section mechanics, who only issue on presentation of a voucher signed by the driver. It is customary to fill up the tanks at the beginning of each day's work, this supply being sufficient for 24 hours' running without a refill. The amount of fuel given out is entered up against the car receiving it. No driver is sent out without a written order from the officer in charge, and on returning to headquarters each driver must report the number of runs he has made, from what points, and the number of men carried. The officer calculates the distance covered from these reports, and enters this distance in the books opposite the gasoline supply. Although no ambulance goes out without an order, a certain amount of liberty of action has to be left to the men when on front-line work. The dressing station may be busy and keep the ambulance going trip after trip without a stop, it may be for hours on end. It frequently happens, too, when working on shelled roads, that the drivers pick up men as they fall and hurry with them to the nearest dressing stations, or they are hailed by the traffic police and loaded up with cases which will not brood an instant's delay. This is the unforeseen, but ever-to-be-expected feature of an ambulance driver's life. But whatever the incidents, they are all noted on the back of the order form and handed to the officer when a return is made to headquarters.

This system involves a minimum of bookkeeping and yet gives accurate control. The gasoline question has been so carefully worked out that the officer in command of the automobile service for one of the French armies informed me he could estimate to within 10 per cent accuracy the gasoline consumption for an army division for any given month. The amount varies according to weather and road conditions —it is not the same in January as in July. Narrow roads and poor surfaces make one district show a higher gasoline consumption than another; during an offensive the miles per gallon goes down a little, owing to the greater amount of time the motors are running idle in traffic blocks. Carried out on the big scale prevailing on the French front, very valuable data are obtained. Not only does an extravagant section reveal itself immediately by comparison with its companions, but the qualities and defects of different makes of motors and carbureters are revealed so accurately that the authorities have been able to insist on makers adopting improvements, and in some very important cases they have scrapped carbureters originally supplied in favor of others having proved themselves sufficiently economical to pay for the change.

Incidentally it may be mentioned that the same system has been applied to touring cars, every machine being given a log book in which must be entered all gasoline, oil, tires and spares received, all repair work done, all trips made and mileage covered. Theoretically, the officer should sign for every trip; in practice, however, it is a very difficult matter to keep these books up to date, for the officer neglects to sign and the driver does not like to insist. These difficulties are not met with on the general automobile and ambulance service, however, where there is a section officer in charge.

Most of the early French ambulances are slightly modified touring car chassis, the modifications being a longer wheelbase and a rather big rear overhang. The section to which reference has been made in this story consisted of Rochet-Schneider 4-cylinder cars, 95 by 140 mm. bore and stroke. They carry four stretchers or eight sitters—occasionally 10 sitters would be put in, making a total load of 12 with the two drivers, and according to the return sheets their lowest gas consumption is 22 liters and the highest 27 liters per 100 kilometers. This is equivalent to 10.3 and 8.7 miles to the American gallon, and is considered satisfactory for the kind of work undertaken.

French Standard Ambulance

In place of the four-stretcher ambulance the French have adopted a standard type of 5-stretcher body, in which the center aisle is used to carry a fifth man. In practice this center aisle is never needed, for wounded soldiers never are attended unless they have gone mad, and in such a case only one patient is carried at a time. The great majority of these standardized bodies are fitted to Fiat chassis, which are a light truck type, on touring car lines, with four-cylinder motor 80 by 140 mm., four-speed gearset, and steel disk wheels, with twin tires on the rear. Providing the axle has been designed for carrying twins, these are much more advantageous than singles for ambulance work; tire troubles are diminished, and the cars can operate on grease and in snow, which can only be negotiated with difficulty with tire chains on single tires. By the use of a light but fully inclosed wood body it has been found possible to produce a very successful ambulance with a motor as small as the 80 by 140 mm. Fiat.

Some of the sections on the French front, particularly those handled by Americans, are using Ford ambulances exclusively. Before the Fords are sent to the front the automobile authorities put an extra leaf in the rear spring (making nine), fit a tie rod under the rear axle housing, and put 3½ tires on the front wheels; with these changes and a very light canvas body, the cars are considered satisfactory. Drivers speak well of them and claim that they can do better front-line work than any other vehicle. They are limited, however, to two stretchers and six sitters; thus when evacuation has to be undertaken they are hopelessly outclassed by the European types.

Hayes Mfg. Co. Makes Tool and Battery Boxes

THE Hayes Mfg. Co. of Detroit is now putting out a complete line of tool and battery boxes. These are distributed by the Onguard Auto Necessities Co. of the same city, and are constructed of sheet steel. They are finished in enamel and are equipped with locks. The sizes in which they are made are in sufficient variety to afford a box suitable to any make of car and providing a neat receptacle for tools which would otherwise be scattered about. The prices are included in the following tabulation:

STOCK SIZES, INSIDE MEASUREMENTS

Style	Length In.	Width In.	Height In.	Price
Y	12	8½	10	$2.50
A	13½	8	10¼	2.75
D	16⅝	9	10¾	3.00
J (Special Ford Size)	18	8	7	2.50
A T	20	8½	10¼	3.50
F	22	9	10	4.00
H (Special Ford Size)	22	9	7	2.50
W	24	10	9	4.50

The 260-Hp. Mercedes Engine

Part III

A Detailed Technical Description of the Latest Type of German Aircraft Engine Furnished by the British War Office and Based on Data Obtained from a Captured Gotha Warplane

EDITOR'S NOTE—In previous issues of THE AUTOMOBILE AND AUTOMOTIVE INDUSTRIES *a detailed description of the 260-hp. Mercedes engine, taken from The Automobile Engineer of London, was published. The figures and data printed herewith in connection with the description of this engine were supplied by the British Naval and Military authorities, and should be of considerable interest to aircraft engine designers.*

WHEN certain minor repairs had been effected power readings were taken from the engine at full throttle from 950 r.p.m. to 1600 r.p.m., and simultaneously fuel consumption readings were taken.

During the test the water outlet temperature varied from 75 deg. C to 81 deg. C. A water brake was used, and this was set to absorb full power at 1400 r.p.m. The engine was gradually throttled down to 900 r.p.m., power and consumption readings being taken. The test results were plotted, and these will be found in Fig. 1.

At the conclusion of the readings a run of one hour's duration at 1400 r.p.m. and at full throttle was made with the following results:

Average b.hp.	0.252
Gasoline, pints per hour	152.5
Gasoline, pints hp. hour	0.605
Oil, pints per hour	8.125
Oil, pints hp. hour	0.032
Oil temperature at end of run	54.5 deg. C.
Water outlet temperature	80 deg. C.

It was noticed that at speeds below 1150 r.p.m. the vibration was rather excessive. No adjustments were made to the engine during the tests.

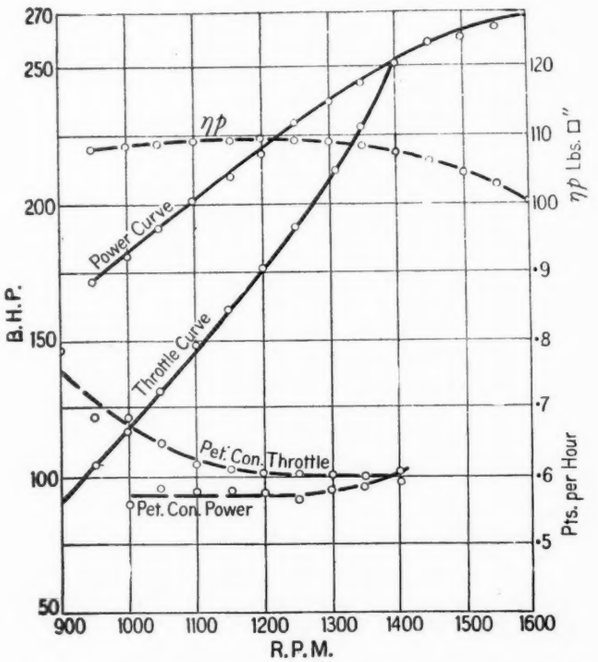


Fig. 1—Curves taken by the British Naval and Military authorities

The following other details and data were taken:

Bore	160 mm.	6.30 in.
Stroke	180 mm.	7.09 in.
Stroke/bore ratio	1.125 — 1	
Stroke volume of one cylinder	3620 cu. cm.	220.82 cu. in.
Total stroke volume of engine	21720 cu. cm.	1324.92 cu. in.
Area of one piston	201.062 sq. cm.	31.164 sq. in.
Total piston area of engine	1206.372 sq. cm.	186.984 sq. in.
Clearance volume of one cylinder	920 cu. cm.	56.12 cu. in.
Compression ratio	4.94 — 1	
Normal b.h.p. and speed	252 at 1400	
Piston speed	1655 ft. per min. at 1400 1772 ft. per min. at 1500	
Brake mean effective pressure	107.5 lb. per sq. in.	
Cu. in. of stroke volume per b.h.p	5.25	
Sq. in. of piston area per b.h.p.	.74	
Hp. per cu. ft. of stroke volume	329.14 hp.	
Hp. per sq. ft. of piston area	194.6	
Direction of rotation of crank	Anti-clock.	
Direction of rotation of propeller	Anti-clock.	
Normal speed of propeller	Engine speed.	
Oil consumption per hour	8.125 pints (9.14 lb.).	
Oil consumption per b.h.p.	0.0325 pint (0.0366 lb.).	
Specific gravity of oil	0.900	
Type of carbureter	One twin jet Mercédès.	
Mixture control	Automatic.	
Fuel consumption per hour	152 pints (136.8 lb.).	
Fuel consumption b.h.p. hour	0.604 pint (0.543 lb.).	
Specific gravity of fuel	0.720	
Type of magneto	Two ZH6.	
Firing sequence of engine	Prop. 1, 5, 3, 6, 2, 4.	
Numbering of cylinders	Prop. 1, 2, 3, 4, 5, 6.	
Direction of rotation of magneto, facing driving end of armature	Anti-clock.	
Magneto timing	31° early.	
Inlet valve opens, deg. on crank	1° late.	
Inlet valve closes, deg. on crank	49.3° late.	
Period of induction	228°	
Maximum lift of inlet valve	10.125 mm.	
Diameter inlet valve port	55.25 mm.	
Area through inlet valves (total)	35.12 sq. cm.	5.44 sq. in.
Mean gas velocity through inlet valve	158 ft. per sec.	
Clearance of inlet tappet	.018 in.	
Exhaust valve opens, deg. on crank	50.6° early.	
Exhaust valve closes, deg. on crank	17.6° early.	
Period of exhaust	247°	
Maximum lift of exhaust valve	10 mm.	
Diameter exhaust valve port	55.25 mm.	
Area through exhaust valves (total)	34.70 sq. cm.	5.4 sq. in.
Clearance of exhaust tappet	.018 in.	
Speed of revolution counter drive	Camshaft speed.	
Outside diameter of valve spring	1.250 to 1.352 in.	
Diameter of wire	1.56 in.	
Number of free coils	7	
Length of spring	3 in.	
Half compression cam opens exhaust cam	12° A.B.C.	

Half compression cam closes exhaust cam	44° B.T.C.
Diameter of induction pipe branch	75 mm.
Diameter of induction pipe main	100 mm.
Diameter of choke tube	32 mm.
Length of connecting rod between centers	326 mm.
Diameter of crank pin	64 mm.
Length of crank pin bearing	80 mm.
Diameter of journals	64 mm.
Length of journal bearings	64 mm.
Length of front journal bearings	104 mm.
Connecting rod side clearance (total) in piston	2.25 mm.
Total capacity of each petrol tank	95 gals.
Total capacity of each oil tank	7.25 gals.
Total capacity of water in system	6.5 gals.
Diameter of piston at top	159.258 mm.
Diameter of piston at bottom	159.715 mm.
Width of rings	5 mm.
Width of gap in rings in cylinder	16/1000 in.
Diameter of water pump inlet	44 mm.
Diameter of water pump outlet	44 mm.
Weight of engine complete, without water, fuel, or oil	936 lb.
Weight per b.h.p., ditto	3.71
Weight of exhaust manifold	26 lb.
Weight of fuel per hour	136.8 lb.
Weight of oil per hour	9.14
Total weight of fuel and oil per hour	145.94
*Gross weight of engine in running order, less fuel and oil	1098 lb.
Weight per b.h.p., ditto	4.36
†Gross weight of engine in running order, with fuel and oil for six hours	2061 lb.
Weight per b.h.p., ditto	8.18 lb.
Weight of complete cylinder, with valves and springs	34.25 lb.
Weight of complete piston, with rings and gudgeon pin	10.725 lb.
Total weight of complete connecting rod, with gudgeon pin bush	7 lb.
Weight of connecting rod big-end, complete	4 lb. 14 oz.
Weight of connecting rod small-end, with bush	2 lb. 2 oz.
Weight of complete valve, with spring washer and nut (inlet and exhaust)	.759 lb.
Weight of valve rocker, complete	1.246 lb.
Weight of crankshaft, with prop. boss	139.5 lb.

*Allowance for tanks at rate of 10 per cent of weight of fuel and oil.

†Allowance for cooling system at rate of 0.65 lb. per b.h.p.

Analysis of Materials

Analysis shows the chemical composition of the various parts to be as follows:

Timing Gear Wheel

Carbon	0.30%
Silicon	0.27%
Manganese	0.74%
Sulphur	0.025%
Phosphorus	0.030%
Nickel	4.17%
Chromium	1.39%
Vanadium	Nil.

Connecting Rod

Carbon	0.13%
Silicon	0.19%
Manganese	0.52%
Sulphur	0.033%
Phosphorus	0.014%
Nickel	2.83%
Chromium	0.29%

Camshaft

Carbon	0.16%
Silicon	0.27%
Manganese	0.60%
Sulphur	0.052%
Phosphorus	0.014%

Valves

	Exhaust	Inlet
Carbon	1.75%	1.82%
Silicon	0.58%	0.52%
Manganese	0.10%	0.10%
Sulphur	0.048%	0.048%
Phosphorus	0.013%	0.010%
Nickel	Nil.	Nil.
Chromium	10.85%	10.47%
Vanadium and Tungsten	Nil.	Nil.

Crank Case

Total Silicon	0.96%
Graphitic Silicon	0.35%
Copper	4.22%
Zinc	3.65%
Iron	0.81%

Valve Spring

Carbon	0.52%
Silicon	0.07%
Manganese	0.59%
Sulphur	0.060%
Phosphorus	0.031%
Nickel and Chromium	Nil.

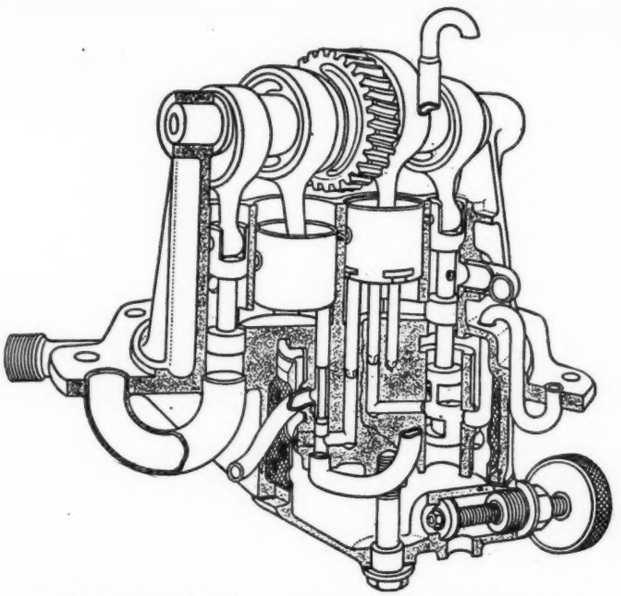


Fig. 2—Details of the oil pump on the Mercedes 260-hp. engine

Camshaft Housing

	Body	Cover
Carbon	0.24%	—
Graphitic Carbon	—	2.97%
Combined Carbon	—	0.62%
Silicon	0.02%	1.81%
Manganese	0.46%	0.53%
Sulphur	0.041%	0.118%
Phosphorus	0.012%	0.085%

Crankshaft

Carbon	0.41%
Silicon	0.29%
Sulphur	0.052%
Phosphorus	0.042%
Manganese	0.64%
Nickel	2.36%
Chromium	0.86%

Mechanical tests gave the following results:

Valve Spring

Compression in inch	Load in lb.	Unloading
0	0	0
.1	6	4⅛
.2	12	10⅛
.3	18	16⅛
.4	24	23
.5	30	29⅛
.6	36	35⅛
.7	42	41
.8	48	47
.9	54⅛	53⅛
1.0	60⅛	59⅛
1.1	66⅛	65⅛
1.2	73⅛	72⅛
1.3	81	79¾
1.4	88⅛	88
	Closed	
1.5	97⅛	

Permanent set—Nil.

Crank Case—Tensile Test

Yield point	8.7 tons per sq. in.
Max. stress	9.35 tons per sq. in.
Elongation	3.55% on 2 in.
Reduction of area	3.5%
Specific gravity	2.867

Crankshaft—Tensile Test

Yield point	55.7 tons per sq. in.
Max. stress	62.0 tons per sq. in.
Elongation	13.5% on 2 in.
Reduction of area	23.5%

Impact Test on Crankshaft

23 ft. lb.	on boss in direction of shaft.
16 ft. lb.	
10 ft. lb.	
3 ft. lb.	At positions indicated in Fig. 3.
3 ft. lb.	

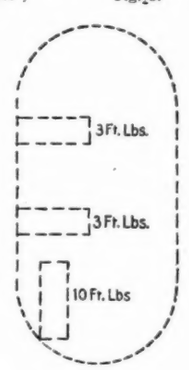


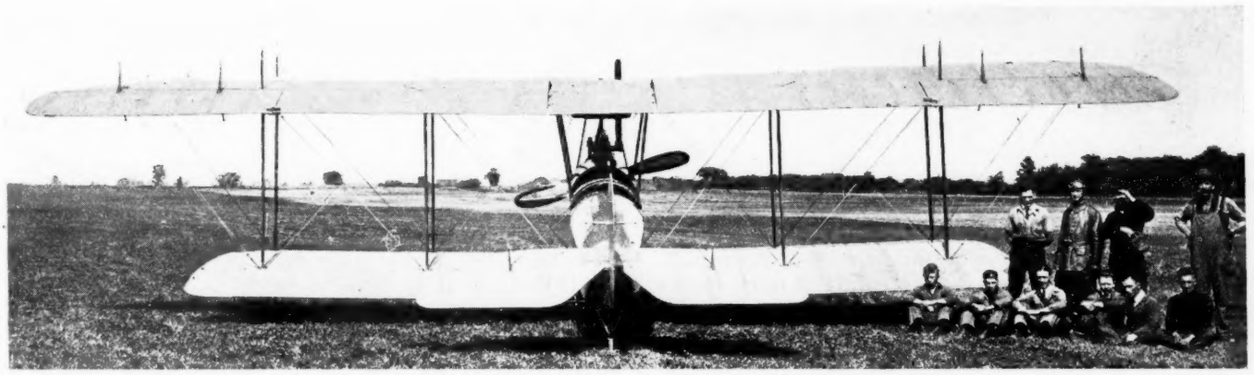
Fig. 3—See table above

Few Engines Sold in Brazil

THERE is a small demand for the smaller sized internal-combustion engines in Brazil. The use of the internal-combustion engine for other purposes, however, is far from being as general as in the United States. The few engines sold are mostly of the smaller sizes, for pumping water, and only kerosene is used. In nearly every port, owing to the heavy passenger traffic along the coast, there are from thirty to forty launches equipped with kerosene engines. As the old ones become worn out and as new boats are purchased there will continue to be a demand for four-cylinder marine engines.

There is a demand in the sugar-mill district of Rio de Janeiro for high-powered crude-oil engines. This class of business, however, generally goes to the dealer who has large engines in stock.

Lawson Primary Training Airplane



THE accompanying photograph shows the latest military tractor biplane built by the Lawson Aircraft Corp. of Green Bay, Wis., to fit the specifications of the United States Government. This machine is a primary training type and one of its chief points is said to be its ability to fly very slowly, as well as to run at high speed when necessary.

This machine, besides being adapted for training aviators, is also designed for reconnaisance work or spotting artillery back of the enemy's trenches. It is said to be capable of hovering over the enemy's lines steadily, thus giving the observer an opportunity to photograph the enemy's position. It is a two seater machine in which the pilot sits in the back seat and the observer in the front seat. The fuselage or body consists of a frame work of spruce and wire. This is later covered with Irish linen, which is doped with various preparations to make it waterproof and fireproof. On top of the body is the fuel tank which has a capacity of 25 gal. and is located just back of the engine bed.

Movable Axle Absorbs Shock

The axle of the landing gear is arranged in such a way that when the wheels strike the ground with great force it can move toward the body a distance of 9 in. In this way the greater part of the landing shock is absorbed and the body protected against destruction. Machines of this type, known as primary training planes, will be used in large numbers for training U. S. army aviators.

A third wheel is provided which is set well forward and takes the place of a skid. In case the beginner lands at too sharp an angle, this wheel will cause the machine to run along the ground for a distance, instead of turning over on its nose, an accident not unusual to beginners with the old style machines provided with stationary skids.

Following are the chief specifications of the plane:

Span of upper wings	44′ 6″
Span of lower wings	32′ 6″
Chord of upper wings	7′ 0″
Chord of lower wings	6′ 5″
Gap	6′ 9″
Sweepback	0
Stagger	9 deg.
Wing curve (upper and lower)	U. S. A. 3
Angle of incidence (upper and lower)	4½ deg.
Decalage	0
Dihedral angle	1 deg.
Height	10′ 0″
Length overall	25′ 6″
Weight, empty	1300 lb.
Weight, loaded	1900 lb.
Useful load: Pilot and passenger, 350 lb.; gasoline, 175 lb.; oil, 25 lb.; accessories, 50 lb.	600 lb.
Loading, per square foot	4.5 lb.
Loading, per horsepower	17 lb.
Speed range	3-66 m.p.h.
Climb in 10 minutes	2600 ft.
Gliding angle (loaded)	1 in 8

The motor is a Hall-Scott A-7a of 100-hp. and drives a nut propeller of 8 ft. diameter and 5 ft. 8 in. pitch at 1400 r.p.m. The Lawson machine has the dual stick control. We are informed that on its first flight, Sept. 11, 1917, under the pilotage of Alfred W. Lawson, the machine left the ground in 40 ft. run and when landing stopped within 70 ft. after striking ground.

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Work of the Factory Metallurgist

From paper read before the S. A. E. by R. H. Sherry.

WHERE tools are of complicated shape, special apparatus is required for the quenching operation and when necessary, such apparatus should be available for the hardener's use. Partial hardening to avoid cracking or warping is often required, and lack of proper equipment frequently taxes the ingenuity of even the most experienced hardener. Streams for interior hardening and sprays for surface hardening should be available, and, where much of the work is of the same kind, fixtures for quenching will be found of value. It is almost impossible to harden interior surfaces or hollows in the regular manner, a statement to which many will bear witness. Steam pockets are almost sure to form, and in some cases the hardening effect will be so irregular that fracture may occur through the excessive strains produced. A heavy stream of water forced against the surface will usually give excellent results. Special methods of quenching will often allow proper hardening. Deep drawing dies, swaging dies and rivet sets are examples of tools requiring special handling.

Treatment of High Speed Steel

The treatment of high speed steel is an art in itself. On account of the high temperature required, 2100 deg. Fahr. or more, and the necessity for judging this by eye in continuous working, considerable attention must be paid to all the essential details. For pieces of any size preheating is essential to avoid scaling or cracking due to exposure to the high temperature for any length of time. Various quenching mediums are used, oil most commonly. Where the tool is of complicated design, susceptible to cracking, molten lead at a temperature of about 800 deg. Fahr. will give excellent results. The final heating should be carried out rapidly and all the fuel which can be properly burned, supplied to the furnace to insure this. For special tools, as, for instance twist drills, special furnaces must be provided.

After the hardening operation, tools, especially of carbon steel, are given a drawing treatment at a low temperature in order to remove strains. This operation is of value with tool steel, and in some cases with carbonized work of complicated design or with sharp corners liable to spall after hardening. This operation will by no means correct the results of improper handling in previous operations, and for carbonized low carbon steel will usually have little or no value, although it is frequently mentioned as a cure-all for troubles.

Two-Stroke Cycle Engine Analysis

Why the Two Stroke Has Made Such Slow Progress—Advantages of Various Systems and Offsetting Drawbacks—May Yet Displace the Four Stroke

By E. H. Sherboudy

IN order to discuss the two-stroke motor in a comprehensive manner it would be necessary to issue not a short magazine article—but a very large volume, and as the author wishes to state the case in as simple a fashion as possible—there can be here presented only a few of the high spots such as the reasons why the two-stroke motor has not been developed for satisfactory use in automobiles and what the future may bring.

First among many reasons that may be given to explain the lack of development in two-stroke engines comes the necessity of constructing satisfactory operating engines quickly and without long courses of costly experimentation; to satisfy the ever pressing immediate needs of one of the fastest growing industries the world has ever seen—then lack of initiative, engineering training and persistence in the face of many extremely difficult problems both of a physical and mechanical nature, on the part of automobile engineers.

Did Not Attract Engineers

The automobile industry in its earlier history unfortunately did not lend the appeal necessary to engage the minds of well trained competent engineers, as is now the case of the aeroplane industry, but rather inventors and mechanics, and sportsmen with mechanical inclinations were the types of men who founded and made possible the automobile industry, and this is usually the condition obtaining in the early development of each of the various arts as they appear.

It is, therefore, not to be wondered that when Daimler produced a successful motor driven road carriage that others should follow in his footsteps, nevertheless trying and succeeding in improving the detail functioning thereof. The Daimler type of engine was copied in all countries and only detail improvements were made in both the functioning and methods of construction.

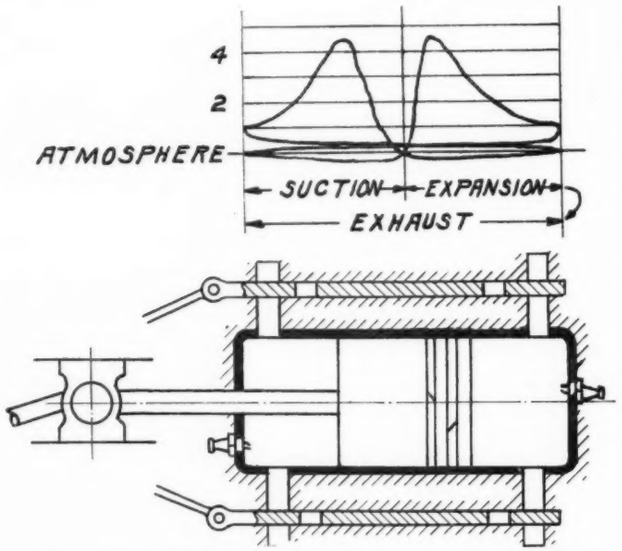


Fig. 1—Lenoir double acting two-stroke, the first commercial engine of this type and the first internal combustion engine actually used

The inherent simplicity of those types of two-stroke engines, which had been developed as stationary and marine gas and gasoline engines, at the time of the appearance of the automobile as a practicable proposition, engaged the attention of a minor number of mechanics and constructors, who copied the existing practice in stationary two-stroke motors, altering mechanical arrangements so as to make suitable applications of these engines to chassis. The earliest types of four-stroke vehicle motors were capable of considerable variation in speed, functioning fairly well through their speed range. The two-stroke motor was, however, not capable of any great speed variation and, while it scored on the point of mechanical simplicity it failed to function regularly and evenly. The power developed per unit of piston displacement was even less than that of the half acting four-stroke cycle. Therefore, those who had at first taken up the two-stroke job because of its simplicity gave it up in disgust and went over to four-stroke engines.

Immediate Causes of Failure

In order to point out the immediate causes of failure of the early two-stroke motor car engines it is first necessary to digress from the main technical questions involved and indulge in a bit of history.

The Lenoir engine was unquestionably the first commercially developed internal combustion engine and several hundred of these engines were built and sold in Paris and London between 1860 and 1870. Artificial gas was at that time in use in both of these cities and the gas engine was looked upon with great interest since it did away with boilers and the attendant labor necessary to the operation of a steam plant.

The Lenoir engine was, to the writer's knowledge, the first double acting two-stroke engine to appear for commercial use. During the first portion of the stroke of the working piston from either dead center a charge of illuminating gas and air were drawn into the cylinder. At or about mid-stroke the charge was ignited by an electric spark passing between two insulated poles in exactly the same manner as with our modern high tension sparking plugs. The current was supplied from wet batteries after having passed an induction coil. The burning charge was then expanded until the end of the piston stroke and during the following stroke the waste gases were discharged from the cylinder. It must here be pointed out that Lenoir did not use compression and was probably unaware of the advantages accruing from the use of compression. Positive scavenging of the burned gases from the cylinder was obtained in the Lenoir cycle, that is scavenging by piston displacement, such as occurs during the exhaust stroke of the four-stroke cycle engine, with the exception that Lenoir's scavenging was more nearly complete.

The accompanying diagram, Fig. 1, clearly shows the pressure time curve obtained from a Lenoir cycle engine together with the schematic cylinder construction.

The first Lenoir motor gave about 1.2 hp. It was 160 mm. or 6 5/16 in. bore 300 mm. stroke. Operating at 81 r.p.m. it gave 1.2 hp. on the brake, consumed 2.88 cubic meters of lighting gas per hour, and 0.4 of a kilogram of oil per hour. The maximum pressure at the end of ignition was about six atmospheres and the thermal efficiency was less than 5 per cent.

The appearance of the four-stroke Otto engine using compression, with its revolutionary economical working stimulated inventors to new efforts and shortly after the appearance of Otto's engine on the market we find the Wittig and Hees two-stroke engine, in which the pump work was carried out in a special cylinder from which the charge was pumped into the working cylinder under great excess of pressure, so that when the transfer of the charge from the pump to the working cylinder was completed, the charge was under the same compression in the working cylinder as was used by Otto. The charge was then electrically ignited and expansion took place during the entire out stroke of the working piston, scavenging on the instroke the same as Lenoir and Otto.

Patents Hindered Progress

By reason of the breadth of Otto's patents, Wittig and Hees were restrained from manufacturing their successful two-stroke engine and the development came to an untimely end. This scheme of operation held at that time great hopes and, but for the unfortunate incident just related, the history of the gas engine might have been a different one.

The Wittig and Hees was developed by the Hanover Manufacturing Company, Hanover, Germany, about 1878. The Wittig and Hees engine comprised separate pumping and working cylinders, the pistons of which were attached to a two throw crankshaft. The pump cylinder was arranged so as to have almost no clearance whatever and the working charge was delivered through a transfer passage, closed at either end by means of poppet valves, to the working cylinder. The working charge was delivered at or near the top of the stroke of the working piston into the working cylinder and was immediately burnt; expansion proceeding quite the same as it does in modern four-stroke engines. Slightly before the end of the expansion stroke the exhaust valve was opened in the cylinder head and during the instroke of the piston the burnt gases were displaced also in the same manner as is done in the modern four-stroke engine. Fig. 2 is a diagram of this motor.

Dugald Clerk's Experiment

Dugald Clerk, who to-day is one of the foremost living authorities on internal combustion engines, was one of the early constructors of two-stroke engines and his engine built in 1878, like many others was an attempt to produce an engine which did not infringe Otto's broad patent. Clerk's engine embodied no new or important cyclic function; its construction is shown in Fig. 3.

One of the types of engines embodying the two-stroke cycle was the Day engine which was invented in 1891. For convenience the two or three-port type of two-stroke engine will be referred to as the Day type, which is approximately correct since the substitution of a piston controlled port for a valve or similar devices does not alter the phenomenon taking place in the working cylinder.

It may also be noted that other forms of two-stroke cycle engines are not widely known, and because of this the two-stroke cycle has been cursed with a particularly

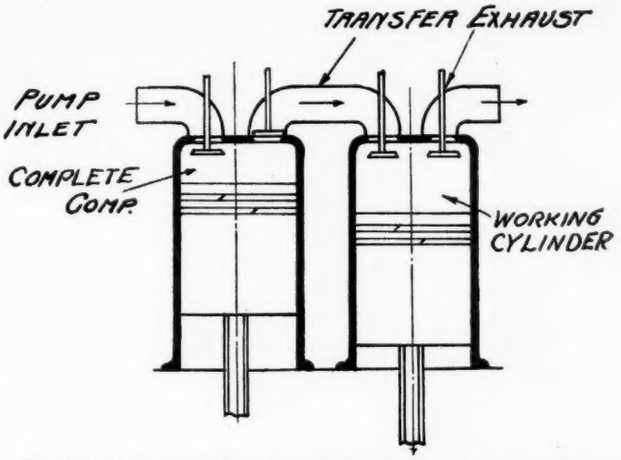


Fig. 2—Witting and Hess two-stroke with separate pump using same compression as four-stroke

faulty reputation, whereas only the form of engine in which the cycle appears is faulty and not the cycle of functioning.

The same form of engine was invented by Claud Sintz, American patents, and also Juliers Schulien, Swiss.

Crank Case Compression

In fourteen years of experience with crankcase compression engines the author has never had any difficulties with crankcase leakage and where this has been a problem it can always be traced to bad workmanship in fitting bearings, or to poor systems of lubrication. The author's contention against the use of the crankcase or the working piston in charge pumping is based wholly on the inefficient results secured, as has been already outlined and, while the simplicity of the scheme lends great appeal from the mechanical standpoint, it is woefully deficient in physical functioning. Notwithstanding the limitations of the crankcase compression type of two-stroke motor, owing to its low cost and mechanical reliability, it has been and will continue to be built for a variety of services other than propelling motor cars. This form of engine has been seen in many commercial forms for application to boats, stationary power plants, automobiles and motor cycles.

Simplicity Misleads

The mechanical construction, as is well known, is of the simplest possible nature and this very simplicity has given rise to false hopes in the minds of inventors, mechanics, and engineers that this was the ultimate heat reciprocating engine. There are at present more than 200 firms the world over engaged in building the Day type of engine for one or another purpose. Sizes of less than one and up to 200 hp. per cylinder have been and are being built. These include gas, alcohol, kerosene, hot bulb and Diesel oil engines, and gasoline engines.

When well designed and constructed, these engines give very excellent results from the standpoint of reliability and overall economy. This should be considered as the cost of power delivered through the life of the power plant, and the original cost of the plant must be charged off together with other operating expenses such as fuel, oil, attendance, etc. Under these named conditions the simple type of two-stroke motor shows exceedingly favorable results.

The specific power output in all cases is relatively low and unless particular skill is possessed by the designer of this type of engine, chronic troubles of an apparently mysterious order appear. The causes of these manifesta-

tions have in the past been little understood and the correction of faulty functioning takes on the appearance of a seemingly impossible task.

Aside from the difficulties attendant upon the design of early two-stroke motor car engines, all gasoline motor constructors were greatly handicapped in matters of carburetion and ignition, and no doubt some of these early motors would have given promise of interesting results had the modern carburetion and ignition systems been available. As it was, these early two-stroke motors overheated, consumed great quantities of fuel, were hard to start, and the greatest annoyance in connection with their operation was backfiring into the crankchamber and thence to the carbureter or fuel feeder, oftentimes setting on fire the car or boat in which they were used.

Details Were Poor

Those little niceties of detail which now characterize automobile and aeroplane motors were entirely lacking, as the general design followed very closely common machinery practice. The art of making intricately cored small castings had not yet been developed and that skill in designing which makes the difference between success and failure, even although the main principles involved have undergone no change, was not yet possible, since the industry was still in its infancy.

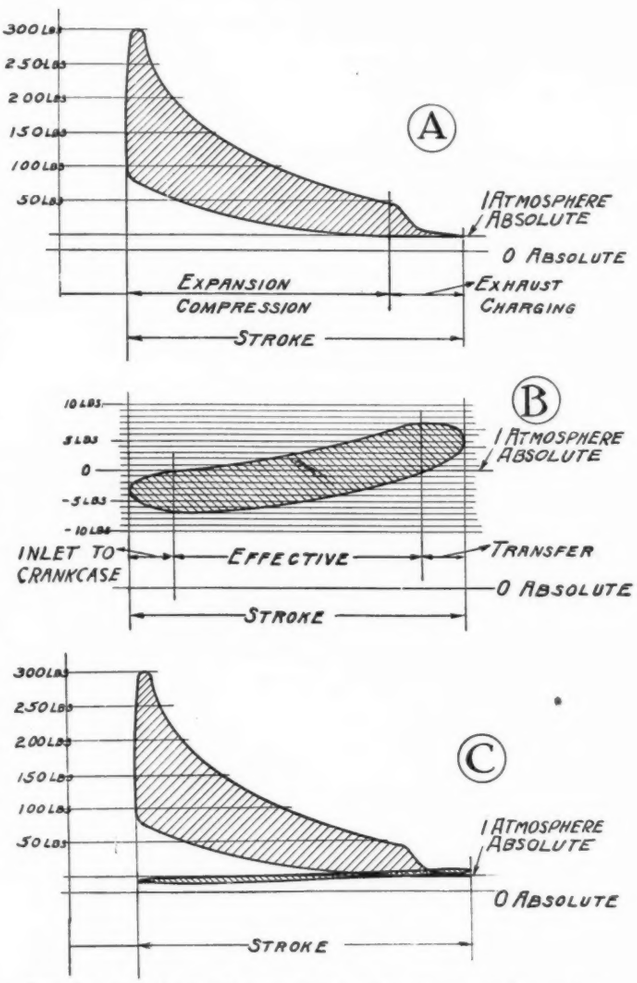
Compression a Trouble

Summing up the foregoing it may be said that the early constructions failed largely because of not using compression of the working charge prior to ignition, and since the charge burned under very low pressures (the area of the combustion chamber during the combustion of the charge was enormous relative to the contained volume), the cycle became more nearly a pure heat cycle, than a mechanical cycle. As is well known heat cycles are better carried out with boilers and kindred apparatus.

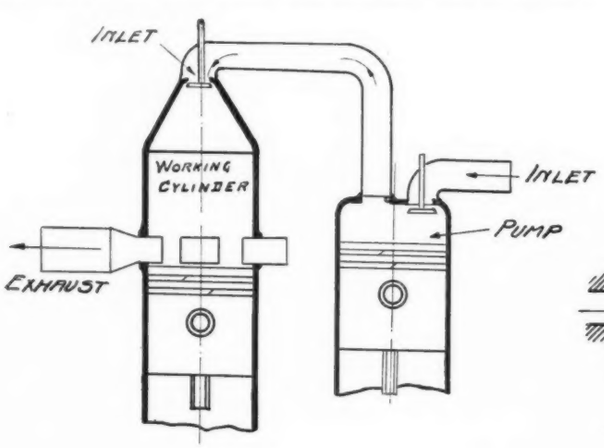
It is interesting to note that while complete scavenging of the products of combustion from the working cylinder is desirable and necessary, the benefits accruing from the use of compression far outweigh in importance those of complete scavenging, complete charging or complete expansion. This was first pointed out by Beau de Rochas about 1862 or at nearly the time of the appearance of Lenoir's engine. It remained, however, for Otto to introduce the use of compression in a practical working engine.

Three-Port Type of Two-Stroke Motor

This type of motor has been called the garden variety of two-stroke and when well designed can show an M. E. P. of 60 lb. per square inch throughout a rather wide range of speed when operated on gasoline of 18,500 B.t.u. per pound. The available speed range and power may be quite comparable with four-stroke motors. As in most all two-stroke cycle motors, governing is undertaken by the working piston in conjunction with ports in the cylinder walls and the functions of exhausting and charging the cylinder are undertaken during about a fifth of the stroke.



Figs. 4A, 4B and 4C—Diagrams for crankcase compression engine, A cylinder chart, B crankcase chart, C combined chart of the two



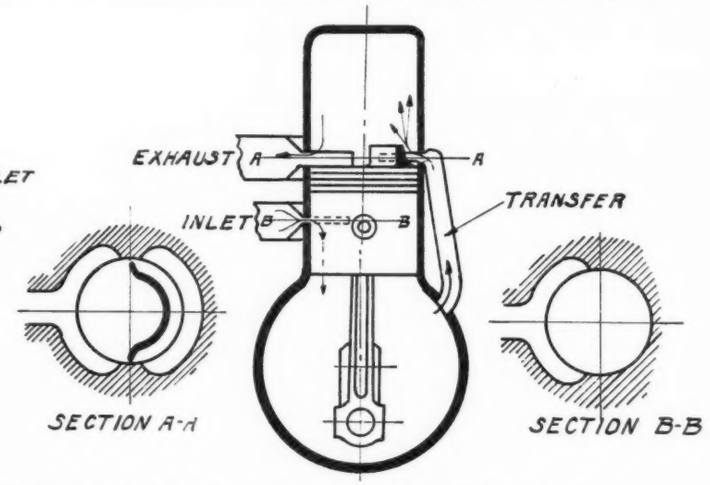


Fig. 3, Left—Dugald Clerk's two-stroke designed in 1878. Fig. 4, Right—Typical diagram of a three-port two cycle motor

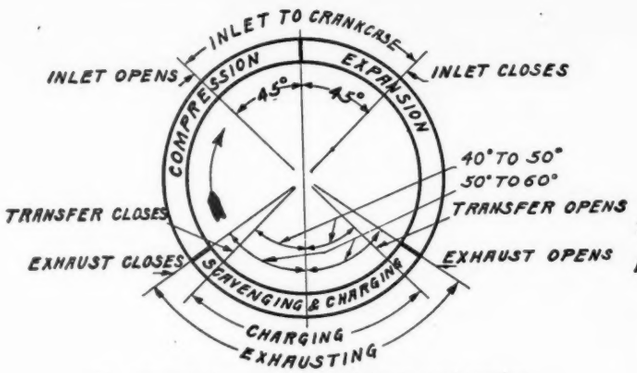


Fig. 4D—Timing diagram for three-port engine

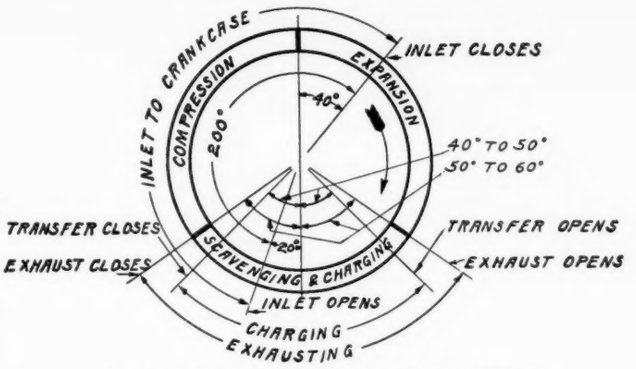


Fig. 4E—Timing diagram for two-port engine

In the three-port type of motor the additional function of timing the pump charging and discharging is controlled by the working piston, and many ingenious arrangements of ports and passages have been invented to carry out this phase of the two-stroke cycle. Ports should be given as much circumferential extent as possible and be kept as narrow as possible in the direction of piston travel, as shown in Fig. 4. From the standpoint of volumetric efficiency the three-port motor is the worst of all types as the height of the transfer as well as the intake port *B* must be subtracted from the piston stroke. The strong heating of the charge by contact with the piston and cylinder passages further decreases the volumetric efficiency. The very great depression in the charge pump prevailing at the beginning of the charging phase (to the pump) and the short period for pump charging causes carburetion difficulties of no mean order. However, once the charge has entered the pump, excellent charge mixing and vaporizing is attained by the violent eddying and simultaneous strong heating during compression and transfer into the working cylinder. In fact it would be difficult to construct a better vaporizer and homogenizer.

Two-Stroke Diagrams

Figs. 4*A*, 4*B* and 4*C* are respectively an indicator diagram from a conventional two-stroke engine cylinder; an indicator diagram of the two-stroke engine crankcase illustrating the larger pump and cycle, and a combined diagram of Figs. 4*A* and 4*B* to the same scale.

Fig. 4*D* is a three-port timing diagram. The timing for successful operation of three-port engines is very narrow and the writer can state with a great deal of assurance after having carried out many experiments in this connection that this timing diagram illustrates the range of possibilities.

Fig. 4*E* is a timing diagram of the two-port engine which only differs from that of the three-port in that a much longer time is to be had in which to fill the crankcase or larger pump than can be had where the working piston is used to govern the charge pump timing. The mechanically operated valve may be used in connection with the charge pump, as an inlet valve and may be made sufficiently large to insure high volumetric efficiency in the pump.

Transfer Condition Bad

The conditions for transfer in the three-port motor from the charge pump to the working cylinder are distinctly bad. As the travel of the working piston is very small during the transfer period the displacer action is poor. The pump chamber then becomes a receiver of such restricted dimensions that it is impossible to keep up the charge flow pressure during the time available for charging the working cylinder. Largely due to the character of this transfer phase, the scavenging of the working cylinder is poorly effected and at low speeds large quantities of fresh charge are lost through the exhaust port. At higher speeds less and less charge is lost in this way in proportion to the quantity transferred from the pump. Losses of this character may be minimized to considerable extent by careful design of the transfer port and the deflector, if one is used, and also by the shape of the cylinder head which complements the action of the deflector.

Owing to the displacement of the piston after the transfer port is closed and until the exhaust port is closed, a further loss of cylinder content occurs.

Gives Constant Compression

Compression commences at the closing of the exhaust port by the top piston ring; always at or above atmospheric pressure, and ends at a constant pressure regardless of the quantity of charge which has been allowed to pass the carbureter throttle. The foregoing is one of the most redeeming features of the two or three port two-stroke motors and the use of constant compression in four-stroke motors would be the greatest improvement possible in that mode of functining.

Ignition and combustion of the charge takes place in an ideal form of combustion chamber, but the phenomenon is sluggish owing to the quantity of burned gases present. These engines therefore require a wide range of ignition timing, always occurring at or before the end of compression.

(To be continued)

Up-To-Date Commercial Directory of Organizations

A THOROUGHLY revised and up-to-date directory of American commercial organizations is now being distributed by the Bureau of Foreign and Domestic Commerce. The organizations included in this directory have been divided into three classes: First, interstate, national, and international; second, State and Territorial; and third, local. The information covers dues, income, number of members, date of annual meeting, address of secretary, and for the local organizations the field of service. The interstate, national, and international associations are listed alphabetically and by trade classifications, and the State and Territorial associations are arranged alphabetically by States and Territories.

Copies of "Commercial Organizations of the United States," Miscellaneous Series No. 61, can be obtained at 15 cents each from the Superintendent of Documents, Washington, D. C., or by applying to the nearest district or cooperative office of the Bureau of Foreign and Domestic Commerce.

Female Labor's Place in Automotive Industry—II

Great Increase of Women in Industry Is Anticipated. England Has Increased Efficiency by Shortening Hours. Employers Must See Women Workers Are Properly Fed.

By Allen Sinsheimer

THE work performed in the English factories by women is mainly unskilled and semi-skilled, and includes capstan, lathe and press working and assembling. Machines in use are automatic and involve repetition and continuous work. Women are also working in the early processes of tool making and saw milling and in fuse factories, cartridge cap plants and shell factories.

As Automobile Testers

Experiments in the motor plants of the United States show that as test drivers they are more careful than the men and that they drive more responsibly through city streets. One hundred girls working in the manufacturing department of the Maxwell Motor Co. as inspectors of small parts and operators of hand press drills have proven themselves qualified for the work. The Chalmers Motor Co., utilizing female labor in light machine work, has found it more efficient, productive and satisfactory than men. One firm manufacturing spark plugs, which are made up of numerous small pieces, uses women entirely for assembly, inspection and light machine work, and is now employing 350 women. This concern finds the advantages and disadvantages as compared with male labor about equal. The Dayton Engineering Co., operating several hundred women workers, has installed a factory school for the girls where they are taught light machine work, receiving the guaranteed day rate while studying. The company finds the women to be as efficient and productive as the men and more capable than the male workers where deft handling of light machinery or small parts is necessary.

It will be seen by the foregoing that female labor, and particularly that section which has never earned a livelihood prior to this war, and that class which is entering into new phases of labor, requires an intelligent and careful direction. Wages as now paid in this country and in the majority of the English plants approximate those paid to male employees. Working hours are now about the same, the eight-hour day having come into general recognition. But the many other details, the feminine temperament, physical ability, intelligence and habits must all be given thought to insure efficient working results.

Labor Leader's Views

Samuel Gompers, president of the American Federation of Labor, gives a clear and concise view of female labor conditions as they now exist in the following expression:

"Much spectacular advertising has been given to women participating in war work. Newspaper stories emphasize only the sensational elements and illustrated magazines present only the sensational. There have been pictures of girls and women working as longshoremen, running up ladders, and hauling trucks in clothing that shows clearly they had not taken up the work as a serious means of earning a livelihood. The newspapers constantly report new plans of railroads and large employers of labor to introduce women workers in work in which men were previously employed, as well as to increase the number of women workers. This change is taking place without the establishment of definite, scientific principles for the formulation of a constructive plan indicating what trades and industries are adapted to women's work and which ought to be maintained exclusively for men workers.

"There ought to be a definitely understood policy that would direct economic government along lines that would promote national and individual welfare instead of injury. Despite the warnings of foreign experience, the development of women's work is rapidly progressing in this country as befits individual convenience of the employers and industries. There is no constructive thought that is guiding the development in furtherance of human protection and welfare. On the other hand, agencies and well-meaning individuals are hastening plans that would bring a greater number of women into gainful employment and would prepare the way for constantly increasing numbers through registration. The peculiarity of this registration method is that it is confined to women instead of covering in a comprehensive way the general field of employment of both men and women. Much of this feverish anxiety to get women into industry is the result of war hysteria and an emotional desire to experience real conditions of war. Along with these feverish efforts to increase the number of women in industry are such reports as that of the New York State Bureau of Employment, which shows that there is no real scarcity of workers as yet in that great Empire State—the industrial and economic center. This report is similar to that which has in the recent past been made from many other states.

Women in German Metal Working Plants

"The reports indicate that we have plenty of time in which to develop the constructive plan based upon principles of economic statesmanship. In developing such a plan we ought to consider carefully such reports as were recently made as a result of an inquiry carried on by the Federation of Metal Workers of Germany in war times. The inquiry was concerned with the position of women's work in the metal trades in Germany in the months of August and September, 1916. The scope of the inquiry covered 207 towns and villages, situated in all parts of Germany in which women were largely employed in metal

trades. Data were secured from 2594 establishments employing 266,530 women and girls. Before the outbreak of the war these same establishments employed 63,570 women and girls. The increase, due to war conditions, was 319 per cent; 85 per cent of the women and girls included in the inquiry were directly engaged on war work. One of the particular points to be brought out by the investigation was whether the work was too hard for women. Some of the statements made by the individual establishments were as follows:

" 'Even for men, and still more for women, work at flanging machines is too hard. . . . At these machines, projectiles weighing from 22 lb. to 82 lb. have to be lifted breast high from the floor and clamped to the bed; then unclamped and placed again on the floor. This entails a great physical strain. . . . In order to earn a wage of three marks (75 cents) a day a woman must perform this strenuous operation seventy-five or even one hundred times. . . . The women complain very much of abdominal pains caused by frequently having to lift (without any tackle) shells weighing 52 lb. . . . In the foundry, women must do any work that may need to be done. They have, for instance, to push the casting pans about, work that overtaxes their strength. One woman sustained a rupture of the groin through performing this work. . . . At steam hammers the persons employed are chiefly women, although plenty of men are available. Women have to draw bomb castings (weighing about 88 lb.), in a state of incandescence, from the furnace to the hammer. A continuous effort is made to employ women at the hardest and most dangerous jobs at steam hammers, shaping machines, core making, pneumatic lifts, transporting heavy cores, casting with pans and with hand ladles. . . . One result of the hard work in this establishment is that of forty-two women nearly one-third have been disabled by illness.'

"Of these women employed in the metal trades, 79 per cent worked from eleven to thirteen hours per day, with much overtime and Sunday work.

Wages Paid Women

"As regards the wages paid these women, the report contained the following statement:

" 'In consequence of the women's lack of training in trade-union usages, many of them have to put up with strange deductions from their wages. Thus, in one establishment there is a custom that piecework wages must not exceed the average time wages by more than 75 per cent. Should a woman, through diligence and skill, earn a larger sum, the piecework rate was reduced in her case. The result is that women workers avoid earning more than 75 per cent above the standard time rate.'

"In addition, the inquiries showed that only 9 per cent of the women were paid at rates corresponding to those paid to men for identical work, many due to the changed economics that are usually established when women are employed.

"It must be considered, also, that women usually come into war work without previous training, and they have to learn the work from first principles. However, war conditions have generally meant opportunity for women. It has meant for many an opportunity for economic endeavors which must be the basis of any real independence.

"There are at the present time reported in the service of the various departments of the British government 150,000 women, employed in some clerical capacity. Many of these women who are employed in the long-established departments and bureaus are paid low wages, with no uniform scale. These wages have been advanced little despite war conditions. In newer offices, and particularly those that have been established directly as the outgrowth of the war, women have been the only clerks available for employment, and consequently have been employed at much higher wages, some getting about twice the wages paid to other women who do identical work. As a result of this condition, the Association of Women Clerks and Secretaries called a meeting in London recently to promote a movement for the establishment of just scales of pay and uniform conditions of employment.

"In the United States there are in existence now many women committees who deal in some way with women's work during the war. It is urgently suggested that one of the first activities of these committees ought to be to determine clearly what trades and callings are adapted to women, and which they ought not to enter except in direct emergency, if at all. When this has been done we will be in a position to advise women as to their welfare, while at the same time insuring the best development of industry, and thereby secure the greatest production with the least interference or fluctuation in output."

Credit for much of the information used in this discussion must be given to the reports of the English government on employment of women in Great Britain during the war and welfare work in British munition factories.

Austrian Airplane Engines

ACCORDING to a report of the aeronautic show at Milan, at which some twenty captured enemy airplane engines were exhibited, in addition to products of the Italian factories, the six-cylinder vertical engine dominated the exhibit. A brief description is given of a new Austrian engine, the Hiero, believed to be named after the well known Austrian racing driver and engineer, Hieronymus, who designed it. This engine is built by Warchalowski, Tissler & Co., of Vienna, who also build an airplane engine named after the senior member of the firm.

The output of the Hiero engine is 215 hp. It has six vertical cylinders, secured to the crank case in blocks of three by means of large wing bolts. A vertical shaft for driving the overhead camshaft, the two magnetos and the pumps passes up between the two cylinder blocks. Each magneto connects to one spark plug in each cylinder so that ignition is two-point. There is a compression relief operated by the axially movable camshaft and an inspection window is provided in the crankcase. An expansion chamber or muffler is fitted to the normal exhaust pipes.

Another Austrian engine, the Rapp, of 165 hp., was represented at the show by two examples. It has its cylinders grouped in pairs and has an overhead camshaft of earlier design. The use of semi-elliptic valve springs with six leaves is a feature.

Correction

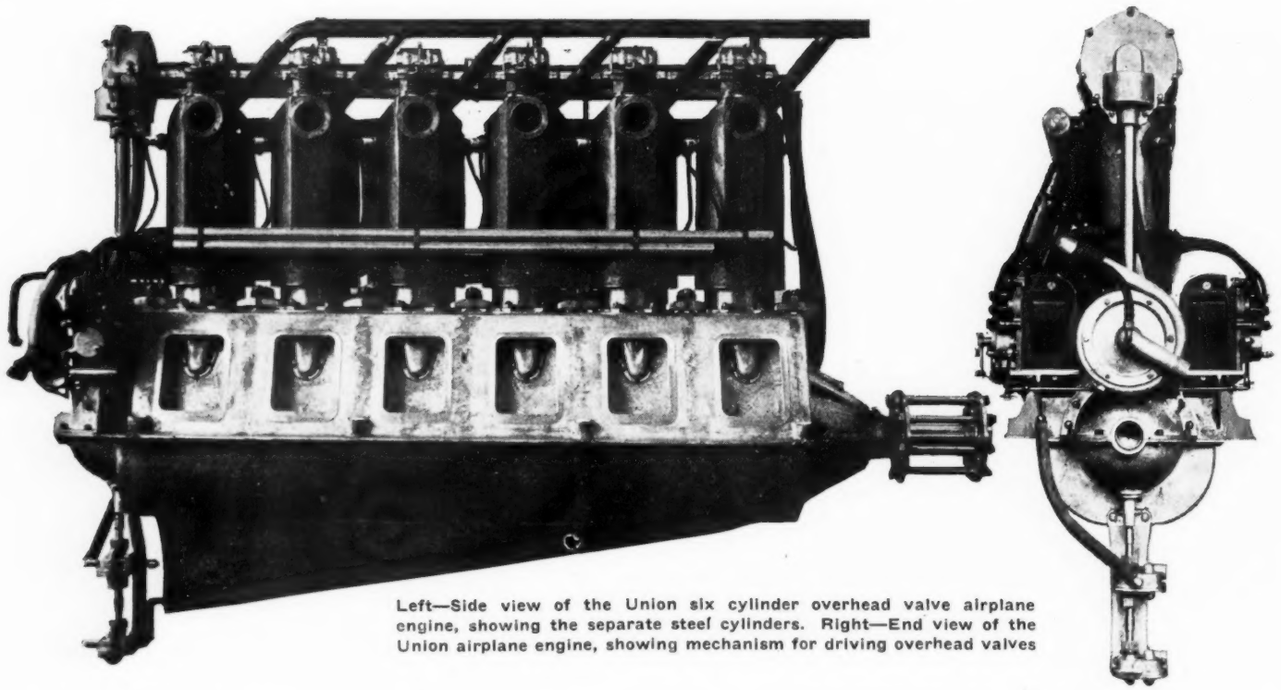
IN THE AUTOMOBILE AND AUTOMOTIVE INDUSTRIES for Sept. 13 it was stated that 12 per cent of the value of rubber manufactures was in automobile tires. This should have read 49 per cent, a figure taken from the census reports for 1914. The per cent now is undoubtedly considerably higher.

Increase in imports of rubber for fiscal years has been as follows: 1914-1915, 11 per cent; 1915-1916, 55 per cent; 1916-1917, 20 per cent. These figures were said to refer to manufactures. They are of imports.

The article states: "The demand for crude rubber has each year been harder to supply." This is quite true so far as the past is concerned; it seems, however, not to be true for the future. Owing to great plantings in the Far East, rather an over than an under production is threatened, and rubber companies are now employing high-paid men to develop new uses for rubber.

Double Crankcase for New Air Engine

Six Cylinder Proves Light and Economical on Test—Steel Cylinders with Copper Jackets



Left—Side view of the Union six cylinder overhead valve airplane engine, showing the separate steel cylinders. Right—End view of the Union airplane engine, showing mechanism for driving overhead valves

THE Union Gas Engine Co. of Oakland, Cal., is manufacturing a six-cylinder, valve-in-head, water-cooled airplane engine, developing 120 hp. at 1350 r.p.m. This engine was tested under the supervision of Army and Navy inspectors during May, having been given an endurance run of 48 hours, consisting of eight consecutive full throttle, 6-hour runs, followed by a tilting test. The main tests were carried out on a cradle-type dynamometer with propeller attached directly to the crankshaft. On this test the maximum power developed was 123.5. The engine averaged 118 hp. on the last day of the run and had an overall average of 120 hp. The average gasoline consumption was 10.7 gal. per hour, of .558 lb. per brake horsepower-hour, while the overall thermal efficiency, based on the brake horsepower, was .222. The average oil consumption was .27 gal. per hour, or 0.124 per horsepower-hour.

The test showed that the engine would perform satisfactorily with a lubricating oil varying from 20 to 30 Baumé gravity. At 1400 r.p.m. the engine has 125 hp., and at a weight of 485 lb. this makes 3.88 lb. per brake horsepower.

Cylinders of Steel

The cylinders are steel, with semi-steel head for the valves and spark-plugs. The base flange is integral with the walls of the cylinders. In test, these cylinders when held by the base flange only, withstood a hydraulic test of over 1200 lb. per sq. in., or a total pressure on the head and base flange of over 10 tons. The water-jackets are of copper, with brazed joints, and the upward thrust of the cylinders is taken by chrome nickel studs extending from the main journal caps to the cylinder flange.

The valves are of E. W. P. alloy and the stem guide is long, and water-cooled for its entire length. The valve springs are double, concentric and of the helical type, right and left-hand. The rocker arms are machined from solid chrome-nickel steel forgings, and heat-treated. The bearings are ¾ in. diameter and 2½ in. long, and the shape of the arms is such that oil leakage is prevented without the use of packing. Excessive wear of the valve stem end, caused by point contact of the adjusting screw, is eliminated by having a line contact in place of a point, the length of contact between rocker end and valve stem being ⅜ in. The valve clearance is obtained by the use of a small cap with thin disks on the end of the stem. The cap is held by cotter so that adjustment is positive.

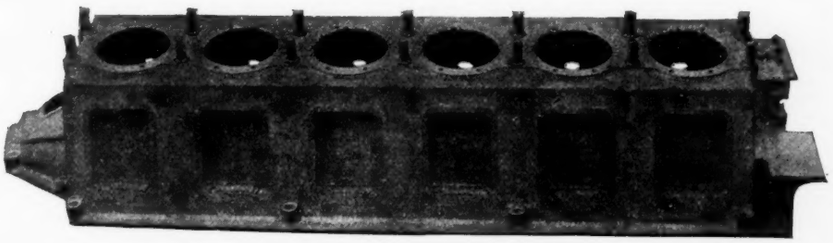
Shaft Easily Removed

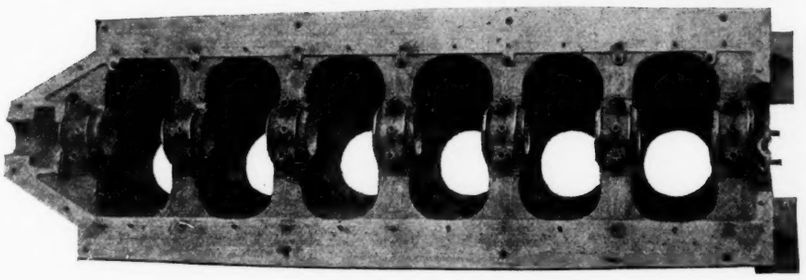
The camshaft housing is split horizontally along the center line of the camshaft, permitting easy removal of the shaft. To prevent flooding of the camshaft housing when climbing, a drain from each end of the housing leads down to the main crankcase sump.

All valve gears are of Midvale chrome nickel steel, heat-treated, and operate in an oil bath. The pistons are of Lynnite aluminum alloy, and the piston length is 6 in., the piston-pin bearing being 1¼ by 2¾ in. The connecting-rods are I-beam section, of Midvale chrome nickel steel, heat-treated.

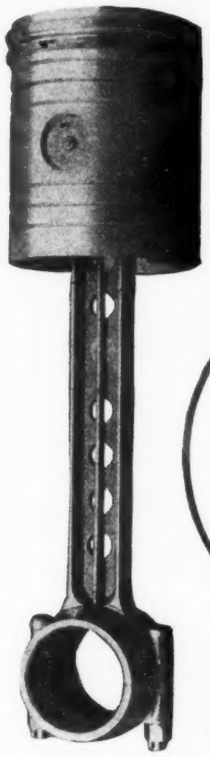
The crankshaft journals are 2½ in. in diameter by 2½ in. long, and the crankpins are 2½ in. in diameter by 3 in. long. In addition to the seven main bearings, there is a bearing just outside of the thrust. The crankshaft is made of Midvale chrome nickel steel, heat-

Special form of valve rocker used on Union engine, designed to prevent oil leakage by extending arm upward, then out and down to the valve stem, thus bringing the port on top instead of below

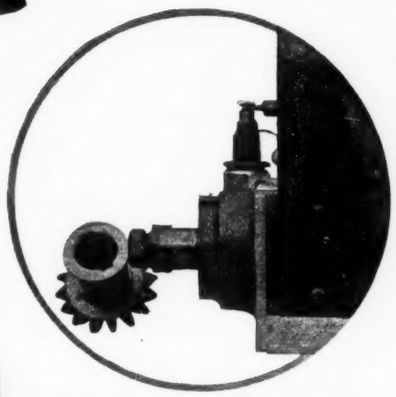




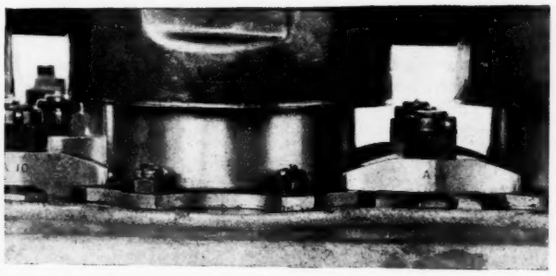
Top—To obviate weaving of the case and the consequent binding of shaft bearings, the side walls are double, as shown. This forms a rigid construction with minimum weight. Note that the case is relieved of all tension by the cylinder studs being extended through the case so as to carry the main journal caps, shown below. Bottom—Union engine crankcase. The small holes in one side of case admit cold air directly to each crankpin, tending to cool each crank and compartment



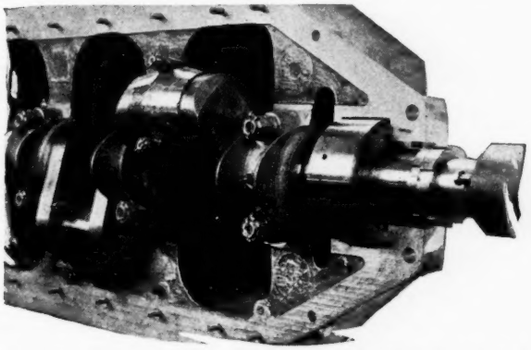
The piston, although it is 4¾ in. in diameter, is 6 in. long. Note that the piston pin is in the center of the effective bearing area (not the center of the piston) and that the bosses in which it rotates are plugged at each end. Oil coming up the tube under pressure must pass through the pin bearing before escaping



Magneto coupling which obviates the transmission of radial and thrust loads from driving gear to the magneto armature



Main tension load between cylinder and shaft is carried by studs passing directly to journal caps. Small studs in the cylinder flange form an oil-tight joint



Crankshaft supported in the top half of the crankcase and ball thrust bearing on same

The crankshaft is made of Midvale No. 11 chrome nickel steel. All pins and journals are 2½ in. in diameter, thus giving stiffness and large bearing areas. The weight is kept down by boring the pins and journals so that their cross-sectional area is low

treated. The propeller thrust is taken by a two-way, self-aligning S. K. F. bearing.

The crankcase is of aluminum alloy, and in addition to thorough cross-webbing, the side walls are of hollow box section. The stiffness of this construction is so great that the entire propeller torque can be taken through the length of the case without any signs of twisting or vibration, the case during this test being held from rotating at the end opposite to the propeller end only.

Oil is taken from the crankcase by a gear pump, delivered to a combined oil tank and cooler, from which it flows back to a second gear pump which sends it under a pressure of 40 to 90 lb. to the crankshaft journals, through the shaft to the lower rod bearing and up into the piston pin. The holes in the piston for the piston pin being sealed, the oil must pass between the outer surface of the pin and its bearing. From here it is carried to the cylinder walls. The camshaft, camshaft bearings, cams, rocker arms and valve gears are lubricated by oil by-passed from the oil pressure regulator. This insures force-feed lubrication to all moving parts, even with no oil in the crankcase.

The current is furnished by two entirely independent magnetos of either Berling or Dixie make. Each cylinder is fitted with two plugs, each plug being in close contact with the water-cooled wall for its entire circumference.

The magnetos are driven through a combined driving gear and floating coupling in such a way that there is absolutely no end or radial thrust transmitted to the magneto bearings or armature shaft. Removing four magneto holding-down screws allows the magneto to be readily withdrawn. The centrifugal water pump is driven in a manner identical to that used for the magnetos, the driving gears and couplings being interchangeable. The pump may be removed by withdrawing its two holding-down bolts.

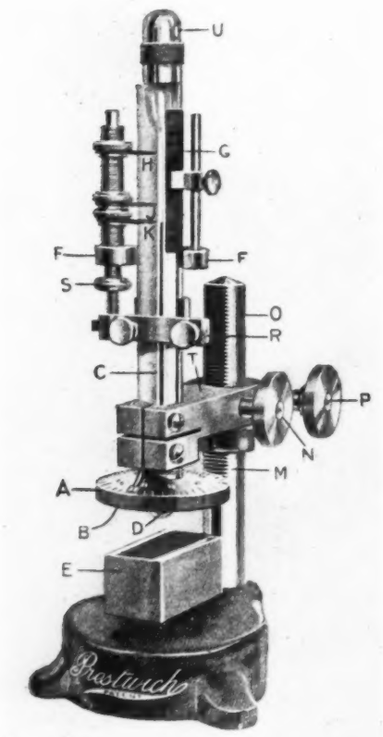
A small breather is located opposite each crank brass in such a way that cold air entering the case strikes each crank brass, thus having a decided cooling effect. Circulation through these breathers is maintained by a small part of the carbureter, air being drawn through the crankcase. The propeller flange may be drawn off the taper by means of a special threaded collar between the flange and thrust bearing. The valves may be quickly timed by means of indicating marks located on the flange between the thrust bearing and propeller.

S. A. E. standard bolt and nut dimensions are used throughout excepting where extra long threads are necessary, as on bearing cap and crank brass nuts. Castellated nuts and cotters are used in place of lock washers, and the bolts not locked in this manner are drilled in the head and lashed by means of wire.

High-tension tested cables from magnetos to plugs are run in two separate metal conduits, thus preventing trouble from induced currents.

Prestwich Fluid Gage for Accurate Work

A FLUID gage for accurate test work in machine shops has recently been brought out by the Coats Machine Tool Co., Inc., New York. It is an entirely novel device for reliably checking large numbers of duplicate parts to close limits, 0.0001 in. or less. All readings of this gage are comparative only, being compared to a master dimension not necessarily known. We understand that a considerable number of these gages have been supplied to firms in the automotive industries, such as the ball bearing and electrical equipment industries. In automobile manufacture proper the gage is used for testing piston pins, push rods, push rod guides and valve stems. It is also used for testing steel balls as to accuracy of diameter and as to sphericity, for checking ball races, the grooves of ball retainers of annular races and as a tool room inspection gage for checking plug gages.



Prestwich fluid gage

The instrument consists of a fluid containing chamber A, having a flexible diaphragm B, a glass tube C of fine bore which is connected with chamber A, means for indicating the dimensions of the piece and means for correcting for variations of temperature. The diaphragm B is provided with a hardened steel anvil D. The article to be measured or gaged is placed between this anvil D and the fixed anvil E. Any pressure on anvil D causes the fluid to rise in glass tube C.

The chamber A is provided with a thread and micrometer index and pointer on the upper surface to indicate thousandths of an inch (or hundredths of a millimeter). Carrier F is provided with a scale G and three adjustable pointers H, J and K, the scale being divided to indicate ten-thousandths of an inch (or thousandths of a millimeter). The two top pointers H and J indicate the tolerance limits it is desired to work to. The bottom pointer K is set to the normal level of the fluid in the glass tube C. Carrier F is adjusted by means of thumb nut S to keep the bottom pointer K level with the normal level of the fluid, and thus compensate for variations of temperature.

The instrument is roughly set by rack M and pinion N on the pillar O to suit the article, the clamping screw P is then tightened up and the final adjustment made by the micrometer adjustment to a standard gage or piece of known dimensions. A displacement of diaphragm B causes a displacement of the fluid level in the tube C relative to their respective areas. Any variation in the size of pieces placed under the gage is indicated by the difference in the height the level rises in the glass tube.

Handling the Increased Rail Traffic

FROM reports compiled by the Railroads War Board regarding the increased traffic produced by the war it is learned that although excellent results have been achieved to date through the co-operation of the shippers, the traveling public, and the railroads, it will be necessary for all concerned to exert renewed efforts, as the abnormal demands upon the railroads in the movement of both troops and supplies are constantly increasing, while the securing of new equipment is virtually impossible. From now on 2500 cars a day will be required by the government to move food, etc.

Post-War Competition to Be Heavy

Foreign Countries Preparing for Big Trade After the War—New Fields Must Be Looked For—Competition Will Be Intense

THE consensus of opinion among business men representing 1000 chambers of commerce from the forty-eight States of the Union which assembled recently in Atlantic City at the call of the Chamber of Commerce of the United States is that at the end of the war America will find itself in one of the greatest periods of international trade competition that has ever been known. Such sentiments were expressed by leaders of industry who were making a careful study of present conditions and are also studying what other nations are doing to prepare for trade when the war is over.

Geo. E. Roberts, assistant to the president of the National City Bank, New York, told of the wonderful work that Great Britain is doing to prepare for the post-war trade. England will have to face a great national debt with interest charges of approximately $1,500,000,000 per year, due to the war, and it is essential that she should be bending every effort for re-establishing in order to take care of such a load. An example of how Great Britain has realized how essential it is to look after her industries was shown when soon after the outbreak of the war the government authorized the Bank of England to take over all uncollectible paper from the smaller banks and at the same time guaranteed the Bank of England against loss on this paper.

Britain's Reconstruction Program

Soon after Great Britain's program for handling the war was defined, she took up the work of reconstruction and has already established a cabinet position known as the Ministry of Reconstruction, and as a result the country is to-day seething with national activities and undertakings that will follow the war. One of the major activities is that of closer union of Great Britain with her various colonies, which thought was summed up in an imperial war resolution adopted some time ago as follows: "The time has arrived when all possible attention must be given to the union of the empire to make it independent in regard to staples, foods, etc." It is expected that preferential tariffs will make the carrying out of such resolutions very easy among such countries as Great Britain, Canada, Australia, India, and South Africa.

Another example of how Great Britain is preparing for post-war conditions is the organization of the Empire Resources Development Co., which was organized to select suitable prospects in trade so that imperial activities can be constructed for the good of the empire. This means that in the different parts of the empire investigations will be made to see what industries should be developed and government aid will perhaps be given in this development. Already appropriations of $1,000,000,000 have been applied for this work.

Although little information has leaked from Germany as to how she is preparing for post-war trade, it is known that a bill was introduced in the Reichstag to provide for the re-creating of the German merchant marine fleet for post-war conditions.

With these examples suggesting what may be expected in foreign trade after the war, it is fundamental that if the foreign trade of the United States is to take that position which it must to preserve our status of the nation we must build up a great army of investors who are willing to place their money in foreign countries that we hope to trade with. This is what England and Germany were leaders in.

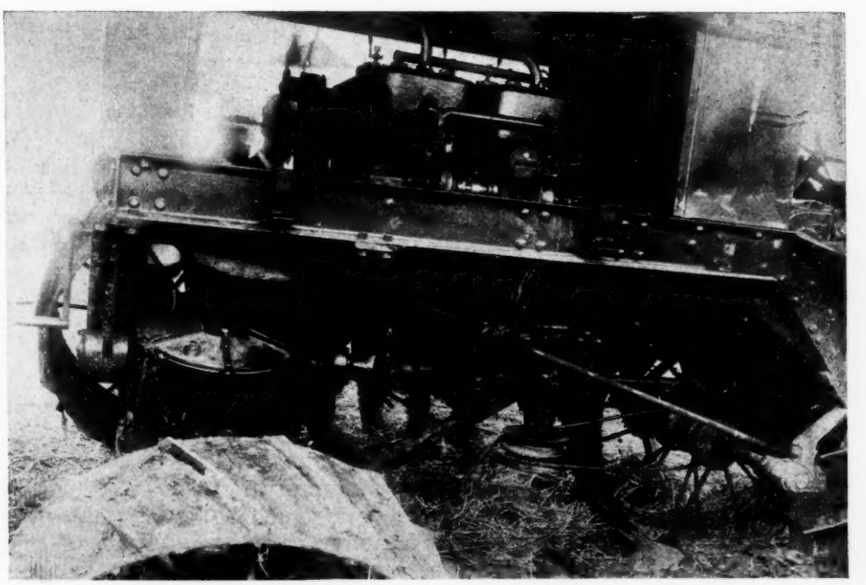
John D. Ryan, president of the Anaconda Copper Co., and familiarly known as the "Copper King" in addressing the convention, declared that the United States will have to greatly improve its foreign trade, and that we are much weaker as an exporting country than many believe and weaker than our export figures would tend to show. Our export figures would give the impression that approximately 50 per cent of our exports previous to the war were manufactured products and 50 per cent raw materials. This was not the case, as bar copper, for example, was classed as a manufactured product, whereas it should be classed as a raw material. After carefully revising the export figures, Mr. Ryan declared that 68 per cent of our exports were raw materials and only 32 per cent finished products. Our manufactured exports averaged only $3.50 per head of population. He declared that this point is where we will have to begin after the war unless we take urgent steps at present to spread our export trade along new lines.

Trend of Post-War Trade

Mr. Ryan believes that after the war world trade will to a large extent follow the same channels as it did previous to the war and cited as an example Russia, which was supplied by Germany with nearly all she needed previous to the war, and will undoubtedly buy from the same source after the war. Germany has supplied Russia for a generation and America will have difficulty handling the Russian trade as well as Germany. America then must look for other trade fields.

American business when the war is over will find itself in a world of fierce competitors and reluctant customers, neither of which will be the result of the ill will of nations toward us, but the inevitable development growing out of the urgent need of the nations.

The future will demand that business statesmanship must supplement political statesmanship.



This view of a four-drive tractor shows the great flexibility of the front axle, which both drives and steers on a central pivot

The Automobile and Automotive Industries

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Smaller Scrap Piles

WE have no Hoover to watch that the unnecessary appetites of our industries are not gratified at the expense of our industrial economy. While the garbage cans behind the kitchens of our homes have become the object of searching investigation, the scrap piles behind our factories have not as yet come under official ken. The parallelism is precise and some of the lessons we are learning in domestic economy from our Food Administrator could readily be applied to our study of industrial economy.

It is gratifying to note that from all over the country come reports that scrap piles are from 10 to 50 per cent smaller than they were a year ago. The welding flame is putting into good condition thousands of forgings that a year or two ago would have found their way into the carts of the junk dealer. Broken tools that were formerly thrown away are now being mended and made again to perform useful work. Workmen are being instructed in the art of waste prevention in the handling of dies and other costly products of the toolroom. All this is having its material effect upon the size of the scrap pile.

Metallurgists say that they can learn more from the scrap pile behind the factory than they can gather from test specimens taken from production. What is true of the metallurgist is true of the efficiency expert in the plant. The scrap pile should continually be under his watchful eye, and particularly now, for the selfish reason that it costs less to save metal parts in the majority of instances than it does to scrap them, and, furthermore, for the unselfish reason that if this policy is adopted by all the plants in the country it will mean the conservation of thousands of tons of valuable metal.

One good man with an oxyacetylene flame can conserve hundreds of pounds of forgings per day in which defects of even a serious nature exist. It is a growing practice in all plants to have these men working in close conjunction with the forging departments in which it was formerly the practice to simply lay the defective forgings to one side, from where they eventually found their way into the scrap heap. Rejection by the inspector no longer means that the part rejected must go into the scrap heap, and thus the pile is growing less. This is a healthy movement, which should be encouraged everywhere.

Fake Parts

ONE of the deplorable effects of production on a large scale of stock articles is imitation of those articles. While a complete part may be protected by patents, it is impossible to prevent the marketing of replacement pieces for that article, as, for instance, breaker blades for a timer or magneto.

In nearly every case the imitation piece is of inferior quality, because it can only find a demand by underselling the genuine part. Indications are that while some imitation parts of well-known articles on the American automobile market are sound and usable, the great majority are not nearly so good as the genuine ones. Unscrupulous dealers are selling imitation instead of genuine parts, and the innocent user is being misled into thinking he can buy something just as good as the genuine piece for a lower price.

Again, taking an ignition part as an example, contact points look much the same, whether they are made of platinum or babbitt metal, but the operation will be vastly different. Yet what is the manufacturer of the real part to do? How can he prevent damage to his reputation through the sale of spurious replacements?

Fixed Price Advantage

There is one way in which the difficulty can be overcome completely, but it is, unfortunately, an illegal way. If the retail price of a replacement piece could be absolutely fixed from coast to coast, any one buying cheaper would know that he was getting an imitation, and taking his own risk. The intention of the law preventing retail price agreements may be excellent, but here is at least one instance where it works to the very real disadvantage of the consumer.

There seems to be only one course, and that is the branding in unmistakable terms of the genuine article. This would have to be accompanied by means for bringing to the consumer's attention the fact that unbranded goods were not to be trusted. There is need for the concentrated effort of the big trade organizations in this matter, and perhaps it is to the dealers that we should look for the best solution of the problem.

Exports

THERE is now no ban on the export of automobiles and their parts to countries other than those contiguous to Germany or Austria. This means that no restriction is placed upon markets which are anxious to buy for legitimate use, no restriction on the development of those markets which ought now to be developed in order to obtain a hold before European competition recommences.

To the American manufacturer a large part of the world is closed, but a large part is open, and the open part is one where the European exporter has had the stronger grip.

The Bad Driver

WHAT is to be done with that small minority of bad drivers who are a perpetual menace to the average road user? The bad driver is a minority, and a small one, but if means cannot be discovered to curb him his numbers will increase. Bad driving is mostly due to ignorance and lack of imagination, to inability to judge speed and distance, which leads to the taking of chances without understanding how slim they are. It is more rarely due to absolute vice or callousness. Unfortunately the unconsciously bad driver is just as dangerous as, if not more dangerous than, the vicious driver to other road users.

Examination Fallacy

It is often urged that all applicants for licenses should undergo a driving examination, and that the possession of a certificate should be an essential preliminary to taking a car on the road. The sponsors of this scheme cannot have much knowledge of the subject, because it is both unworkable and useless. It is unworkable because it is only upon the road that a man can learn road driving, it is useless because the sort of bad driving that provokes accidents is not the sort that will be discovered by an examination.

The modern car is so easy to handle mechanically that anyone can learn to operate it, and starting, stopping, negotiating traffic, etc., are easy. No examination will show whether a man is the sort of person who will rush blind cross roads or grade crossings, or will try to squeeze through between approaching vehicles.

The other popular panacea is rigidly enforced speed laws, and these have some applicability to towns where the speed on a highway is some index of recklessness. In the open country the man who drives at 60 m.p.h. in safe places and slows for crossings is not a danger, while he who sticks to a steady 25 m.p.h., crossings and all, is a maniac.

There is a clause in the British law, applicable to the whole United Kingdom and to Ireland, which has worked well, though open to police abuse. By British law a driver may in case of actual, or even only threatened accident, due to his recklessness or carelessness, be indicted for "driving to the common danger." If convicted for this offense the magistrate may either suspend or revoke the driver's license to operate a car, in addition to fine or imprisonment or both. After more than one conviction the license is almost always taken away for a year or more. To drive without a license is punishable by a $250 fine, or by imprisonment.

This law has been applied rigidly and with fair justice, erring perhaps on the side of severity, but it has been of assistance in causing the number of accidents in proportion to volume of traffic to be extremely small.

Driving License

The driving license, for which $1.25 is paid, is issuable to everyone over seventeen. At the back of the license are some blank sheets on which a record of convictions for dangerous driving are entered by the convicting court, these being copied to the new license when applied for. Licenses are renewable annually, but the record of convictions stands. Knowledge of the law restrains a driver from risking accident in the first case, and a man who has an already endorsed license is immediately suspected as being the offender if he be involved in a second accident. In several cases wealthy men who had their licenses revoked for a succession of smashes were jailed for some months without the option of a fine, on being caught without a license.

Though, as already stated, this is not altogether an ideal scheme, it does work well. The license, in effect, says "the possession of this ticket allows you to drive as long as you do so reasonably; if you drive dangerously it will be taken away from you. Without it it is a penal offense to drive a car."

Mark Main Roads

Another scheme which has never been tried on a large scale, but which sounds promising, is to very clearly mark each junction of main and side roads, so that a driver can know what he is approaching. The traffic of the main road would have the right of way, and an accident caused by a man entering from a side to a main road would be upon his head. This should be a help in reducing accidents, but without something resembling the licensing system for drivers it would be insufficient.

It is the duty of road users to agitate for the universal application of a sensible law which will make driving still safer for the great majority, which will severely punish the deliberate offender and in extreme cases prohibit him from driving. It is a matter for the industry to consider, for all the manufacturer, dealer and user organizations to agree upon. The automobile world can do the job better than political lawmakers, and if it speaks with one voice it will without question get what it desires.

□ Latest News of the

Ford Challenged By Overland

Overland Reveals Brand New Model To Sell Under $500—Big Output Scheduled

TOLEDO, OHIO, Oct. 4—*Special Telegram*—The expected and long-looked for has happened in the cheap car field by the announcement that John N. Willys, of the Willys-Overland Co., has finally completed, tested out, and settled on every detail of the new Overland car which is to rival the Ford. For several years the Willys-Overland Co., has been working on this car. It was expected a year ago but many previous models have been rejected. The new Overland comes as a direct challenge to the Ford in the low-priced field and plans are already matured for building it in enormous quantities, apparently to out-production Ford. While the price is not stated, it will sell for less than $500 and will carry a complete equipment, including electric starting and lighting with combined dimmer control. In its complete equipment form, including starting battery, the lighting system, an extra tire, and tire carrier, the weight is 1500 lb. Tires are the same size as those used on Fords.

Externally the body is somewhat different from other Overland types, due largely to a unique system of springs, which give a distinctive appearance to the front and rear, and while the wheelbase is 100 inches it is claimed that this spring suspension system gives the effect of a car having a wheelbase of much greater length. Using the standard

(*Continued on page* 609)

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Willys Heads Army Recreation

WASHINGTON, Oct. 3—John N. Willys has been appointed chairman of the National Committee on War Camp Community Recreation. He will direct the campaign to raise a fund of $3 for every soldier and sailor to provide recreation.

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Baker a Brigadier General

WASHINGTON, Oct. 3—Col. Chauncey M. Baker, chief of the Transportation Division of the Quartermaster's Corps of the army, has been nominated for brigadier-general. Colonel Baker has spent 35 years and 3 months in the military service up to October 1.

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Ewing Heads Michigan Copper

DETROIT, Oct. 3—Alonzo T. Ewing has been appointed vice-president and general manager of the Michigan Copper & Brass Rolling Mills. The company is closely connected with the General Motors Co. and the United Motors Corp., having been taken over recently by C. S. Mott, Alfred T. Sloan, Jr., Walter Chrysler and others. Ewing will have active management of the company. N. D. Wallace has been elected a director succeeding E. C. McCrone.

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FRENCH PLANT TO BUILD LIBERTY MOTORS

NEW YORK, Oct. 2—It is learned that the recent purchase for $3,000,000 worth of machine tools by the J. G. White Engineering Corp. was for the purpose of equipping the plants of the Brasier Automobile Co. and the Renault Automobile Co. in France to produce Liberty motors. These plants will also be used for building and repairing American airplane engines.

Orders placed last week by the J. G. White corporation are said to have been as follows: 126 grinders, 194 lathes, 60 turret lathes, 97 milling machines, 45 automatic lathes, 17 boring mills, 2 tool grinders, 85 drill presses, 57 gear cutters, 53 miscellaneous tools, a total of 736.

There have been inquiries put out during the past week by airplane engine makers in Italy, who will probably require a large number of machine tools for expansion of that country's airplane-building program.

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Premier to Build Four-Wheel Drive Trucks for U. S.

INDIANAPOLIS, Oct. 1—The Premier Motor Corp. has received a large Government contract for four-wheel drive trucks. These are to be built under license from the Four Wheel Drive Auto Co., Clintonville, Wis. For more than a year the Peerless Motor Car Co., Cleveland, has been making Four Wheel Drive trucks for the Government under a similar contract.

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Record Demand for Show Space

NEW YORK, Oct. 2—The allotment of space in the New York and Chicago shows by the Motor & Accessory Manufacturers, Inc., to-day, is only partly finished and will not be finished until at least Saturday. L. M. Bradley, the manager of the association, has been called to Washington. All indications point to one of the largest accessory exhibits in the history of the industry. Members have applied for 50,000 ft. of space at both shows, which is considerably in excess of applications in preceding years. Interest seems to be increased rather than diminished and the war seems to be making no difference whatsoever. Present indications are that the coming shows will far surpass those of previous years.

Makers Combine to Make Ordnance

$25,000,000 Government Order May Take Over Saxon Plant

DETROIT, Oct. 3—A $2,000,000 company formed by the leading automobile makers and others has been formed to make ordnance with a $25,000,000 government contract assured as a starter. Captain Goodspeed of the Government recommends the purchase of the new plant of the Saxon Motor Co. for this deal.

Those interested in the company include: Alvin Macauley, president of the Packard company; Roy D. Chapin, president of Hudson; John Trix, head of the American Injector Co.; George Dunham, engineer; W. C. Anderson, president of the Anderson Electric Car Co.; Harry W. Ford and L. C. Van Bevaer of the Saxon company, and C. A. Pfeffer, formerly secretary of the Chalmers company.

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Australian Import Rule Modified

NEW YORK CITY, Oct. 4—Australia will permit the importation, until further notice, of cowl dashes with instrument board, foot boards, mud guards, windshields, and hoods on automobile chassis. This information has been received by cable by Ernest Hall, official representative of the Commonwealth of Australia, in New York, and comes as a supplement to the action taken by the Australian Government on August 10, on automobile bodies. This official announcement gives the American manufacturer the right of shipping the chassis equipped with all these parts. Complete bodies for motor vehicles cannot be shipped into Australia whether as a part of the vehicle and mounted on a chassis, or separately, unless with the consent in writing of the Minister of State for trade in customs of the government of the Commonwealth of Australia.

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Government Leases Wright Field

WASHINGTON, Oct. 3—The Aircraft Production Board has leased for 3 years the Wright field at North Dayton, Ohio. It will be used as an engineering and experimental field, at which the Federal Aircraft Program will be centralized. Its name will be changed to McCook Field. Offices, shops, hangars and barracks will be erected immediately. The field will be under Lieutenant-Colonel Clark of the Equipment Division of the Signal Corps. He will be assisted by Major Vincent and Captain Marmon.

Automotive Industries

Goethals Made Head of Wright-Martin

Immediately Assumes Active Management—Government Order for 4000 Engines

NEW BRUNSWICK, N. J., Oct. 3—Maj.-Gen. George W. Goethals has become president of the Wright-Martin Aircraft Corp., his election taking place at to-day's meeting of the directors. Both General Goethals and Marshall J. Dodge were elected directors. As head of the airplane company, General Goethals will continue to act in an advisory way to the engineering firm, Goethals, Houston & Jay, 40 Wall Street, New York. J. F. Alvord, who was appointed temporarily last May, retired from the presidency to make way for the General. G. H. Houston, a partner of General Goethals, is to continue as vice-president and general manager of the corporation.

As a result of increasing the facilities for the manufacture of airplane engines, the production of Simplex automobiles will be stopped during the war. The company has sufficient orders to keep it busy during the remainder of the war.

The French order for 450 Hispano-Suiza engines which the company had was unprofitable, due to the low price at which it was taken and high material costs. The corporation recently obtained a large order from the U. S. Government for Hispano-Suiza engines, understood to call for about 4000 of 250 hp. each, to be delivered before the end of 1918.

The annual statement to-day showed as of May 31 a profit and loss deficit of $1,930,387, the result chiefly of losses in making the first engines turned out. Cash on hand amounted to $2,570,680, inventories to $1,987,437, and total assets to $10,566,538.

The cross licensing arrangements entered into by the airplane makers will net the Wright-Martin company, he said, $135 per airplane until the sum of $2,000,000 has been received, after which the patents can be used by members of the cross licensing association without further charge.

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$33,000,000 Gross Sales for United Motors

NEW YORK, Oct. 3—Preliminary estimates of the business done by the United Motors Corp. this year show gross sales of $33,000,000. The trade has been waiting with interest the financial report of this company, which is expected to be out in about 1 week.

Net earnings of the company amounted to $8,500,000 and there was $16,000,000 in excess of quick assets over the current liabilities. The book value of the stock is $28. This does not include good will, patents, etc.

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BUYER TO PAY TAX, ACTION OF CONGRESS SUGGESTS THIS

NEW YORK CITY, Oct. 4—At the regular October meeting of the National Automobile Chamber of Commerce, held at the association headquarters to-day and at which over 100 automobile manufacturers were present, it was the sense of the meeting that the 3 per cent tax on the industry should be added as a separate item on each automobile and truck sold. This action was taken because of the fact that it was the intention of Congress in placing this tax on the industry that it should be paid by the purchaser of the car or truck rather than by the manufacturer or the merchandiser.

At to-day's meeting the drawing for space at the Chicago and New York shows was made, the order of drawing following the same form as in previous years. First position was secured by Willys-Overland, with Buick, Dodge, Studebaker, Maxwell, Chevrolet, Cadillac and Hudson following in the order named. There were three or four remaining exhibit spaces on the third floor of the Grand Central Palace which remained after the four outsiders, namely, Stanley, Harroun, Monitor, and American, had drawn for positions.

The drawing for Chicago space resulted in all spaces in the Coliseum and Armory being taken as well as what is known as the Greer Building.

The annual dinner of the N. A. C. C. scheduled to be held at Hotel Waldorf during show week will not be held.

R. H. Collins, president of the Cadillac Motor Car Co., was elected a director to succeed W. C. Leland, who has entered the aeronautical field.

Five new members were elected as follows: Barley Motor Car Co., Kalamazoo, Mich.; Republic Motor Truck Co., Alma, Mich.; G. A. Schacht Motor Car Co., Cincinnati; Elgin Motor Car Co., Chicago; and the Stegeman Motor Car Co., Milwaukee.

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Aircraft Board Reorganization Pending

WASHINGTON, D. C., Oct. 4—As yet no announcements have been made concerning the reorganized Aircraft Production Board as provided for under the Sheppard Law passed a week ago. Under this law a change in membership of the board will be necessary and while it is known that the matter of reorganization has been planned nothing has yet been given out regarding the personnel.

Doble Patents in Big Tangle

Father and One Brother Claim Control Which Other Brother Denies

DETROIT, Oct. 3—Doble interests as involved in the General Engineering Co., the Steamotor Co. and the Doble-Detroit companies on one side and the Doble family in San Francisco on the other have become involved in a peculiar disagreement.

The peculiar situation has arisen from the fact that William Doble, Sr., has started giving out interviews and publishing advertisements stating he has the sole right to manufacture the Doble car, due to the fact that he is the holder of a patent covering the combustion system, which is one of the fundamental features of Doble construction.

According to letters received from the Doble Laboratories by the Class Journal Co., the John Doble patent referred to, No. 1,131,683, covers the combustion system by means of which kerosene is atomized by mechanical means, producing a fine fog of kerosene. Also the provision for igniting the fog by means of an electric spark is the first claim of the John Doble patent, and he claims that Abner Doble infringes this.

Against this contention the General Engineering-Abner Doble interests point out that all six claims contained in the John Doble patent are limited by the fact that they are simply device claims, which throws all claims made by the William Doble interests into the discard, according to the General Engineering Co., as no such combination is employed in the Doble steam car.

The fact that there are family ties in the matter has kept the matter out of the courts thus far, although either side may proceed at any time.

The Doble-Detroit Co. will begin manufacture of Doble steam cars late this month. The company anticipates that shipments of cars and demonstrators will begin in February and the car will appear at the New York and Chicago shows.

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Standard Truck Motor on Test

DETROIT, Oct. 3—The first of the standard military truck engines has been on test here and has shown very satisfactory power and economy. At a speed of 850 r.p.m. the torque was 256 ft. lb. which is an excellent performance for an engine of this size. Official tests will be made in the military laboratory at Washington whither another engine is now on its way.

Maxwell Earns $29 on Common

Balance Equal to $5,368,546—39 Per Cent Increase in Cars Sold—Surplus $2,506,669

NEW YORK, Oct. 1—The annual report of the Maxwell Motor Co. shows net profits for the fiscal year ended July 31, 1917, of $5,368,546, compared with $5,088,994 in the 1916 fiscal year. Earnings are equal to 29.63 per cent on the $12,778,057 common stock after allowing for dividend requirements of 7 per cent on the first preferred and of 6 per cent on the second preferred, against 27.53 per cent earned in the preceding fiscal year. Net earnings amounted to $5,342,728, against $5,531,034 in the preceding year. The net income amounted to $5,507,697 after deducting a corporation income tax of 2 per cent and without any deduction for an excess profits tax.

In the report to the stockholders, president Walter E. Flanders stated:

"The number of cars sold by us during the past fiscal year shows an increase of 39 per cent over sales the previous year.

"The net working assets of the company and its subsidiaries at the close of its fourth fiscal year are $12,280,977. The inventories have been taken at actual cost; we have no obsolete materials.

"The American Appraisal Co. advises us that the net sound or present day values of these properties, after deducting depreciation reserves of $2,215,296, is $8,305,389, or $2,909,650 more than the net figures at which we carry them on our books.

"Sales contracts with distributers have been signed for 32 per cent more automobiles of all models than had been contracted for at the same period last year."

The refinancing of the Chalmers Motor Corp. has been completed, and all the $3,150,000 first mortgage 6 per cent 5-year notes of the company have been taken by the shareholders and C. D. Barney & Co. and J. S. Bache & Co.

The income account of the company for the fiscal year ended July 31 and for three preceding years is given below.

Income Account of the Maxwell Motor Co. for 1917 and Three Preceding Years

	1917	1916	1915	1914
Net earnings	$5,342,728	$5,531,034	$2,337,950	$1,430,445
Other income	572,176	395,857	222,091	339,979
Total income	$5,914,904	$5,926,891	$2,560,041	$1,770,424
Depreciation	407,207	500,256	256,726	264,956
Sinking fund	139,151	137,641	330,000	.....
Inventory reduction	.....	200,000	.....	.....
Balance	*$5,368,546	$5,088,994	$1,973,315	$1,505,468
Dividends	2,861,877	2,750,013	306,988	.....
Surplus for year	$2,506,669	$2,338,981	$1,666,327	$1,505,468
Previous surplus	5,510,775	3,171,794	1,505,467	.....
P&L surplus	$8,017,444	$5,510,775	$3,171,794	$1,505,468

*Equivalent to $29.63 a share earned on $12,778,057 common stock, after deduction of dividends on the first and second preferred stocks, compared with $27.53 a share earned in the preceding fiscal year.

Balance sheet of the Maxwell Motor Co., as of July 31, 1917, compares as follows:

ASSETS

	1917	1916	1915	1914
Realty buildings, machinery etc	$5,846,738	$4,166,162	$5,192,626	$4,462,222
Investments	1,259,867	1,300,604	795,826	694,656
Goodwill, etc	25,457,363	26,190,469	26,500,000	26,500,000
Inventory	10,813,430	8,971,356	5,146,901	4,588,973
Accounts receivable	1,510,144	743,325	596,119	428,495
Bills receivable	706,952	395,057	229,289	212,455
Mortgage receivable	.....	167,500	95,000	.....
Prepayments	.....	.....	44,757	50,898
Liberty bonds	175,179	.....	.....	.....
Cash	1,852,305	3,269,552	2,652,629	1,785,993
Sight drafts discounted	2,946,384	1,597,095	642,987	.....
Sinking fund	350,185	171,889	.....	.....
Total	*$50,804,146	*$46,841,241	$41,896,135	$38,723,693

LIABILITIES

First preferred stock	$13,915,142	$13,764,120	$12,279,332	$12,279,332
Second preferred stock	10,127,468	10,127,468	10,127,468	10,127,468
Common stock	12,778,057	12,778,057	12,778,057	12,778,057
Dividend warrants	.....	279,742	.....	.....
Plant construction balance	172,018	.....	.....	.....
Definite liabilities	.....	12,709	15,709	30,161
Accounts payable	2,878,431	1,922,892	1,134,150	619,598
Wages accrued	106,082	124,107	120,743	73,485
Taxes, insurance, etc	293,745	98,651	47,909	51,810
Customers' deposits	418,526	483,016	296,421	206,596
Due on contracts	643,913	735,410	109,080	.....
Liberty bonds subscribtion	197,000	.....	.....	.....
Depreciation reserve	.....	.....	1,635,470	951,718
Sight drafts discounted	1,071,320	944,291	.....	.....
First preferred retirement fund	.....	.....	130,000	.....
Contingent reserve	185,000	60,000	50,000	100,000
Surplus	8,017,444	5,510,775	3,171,794	1,505,467
Total	$50,804,146	$46,841,241	$31,896,135	$38,723,693

*After deduction of $114,402 in 1917 and $131,769 in 1916 reserve for doubtful accounts.

Aircraft Board Contracts for Engines

NEW YORK, Sept. 27—Contracts have been let by the Aircraft Production Board with the General Vehicle Co., Long Island City, N. Y.; the Buick Motor Co., Flint, Mich., and the Westinghouse Air-Brake Co. of Pittsburgh, Pa., for the manufacture of the 80 hp. LeRhone and the 110 hp. Gnome aircraft engines.

High-Price Car Business Improves

Open and Closed Cars Selling at More Than $1,500 Find Good Market

DETROIT, Oct. 1—Manufacturers of cars selling for more than $1,500 are noticing a slight improvement in the sales of open cars and are enjoying fairly good business in closed cars. This report, received from several companies, coincides with reports by a large body manufacturer and a bearing maker, both of whom stated that orders were increasing within the past 10 days from makers of cars above the popular prices. They also report an excellent condition of business among large companies making cars selling at popular prices.

The Fisher Body Corp., now producing about 900 bodies daily, states that although business from the more expensive car makers decreased noticeably in the last 90 days, it is now picking up rapidly, and particularly so in the closed body division. The company also reports that its customers selling cars at $400 to $1,200 are doing a record-breaking business.

Conditions reported from various sections of the country point to a continuation of the demand, with the only cloud on the horizon being the tax now contemplated by Congress, and which makers and dealers believe will have a slight tendency in certain regions to slow down sales.

The business received last week is reported by most concerns to be equally distributed throughout the country, while a few report it as "spotty" and state that the Eastern section is beginning to make a larger demand for cars. The Anderson Electric Car Co. reports an increase of business for export with an unusual demand from Japan, to which country the company shipped nine cars last week.

Traffic conditions are becoming a general topic and several companies are now sending officials through the country to learn the best ways to overcome the problems and to confer and advise with distributors and dealers. Large distributors in this territory are advising dealers to drive their cars to their cities when they are within a radius of 200 miles, thus allowing considerably more freight cars for the manufacturers.

$20,000,000 Invested by Packard Dealers in Buildings and Stock

DETROIT, Sept. 28—The Packard Motor Car Co. has just determined that more than $20,000,000 is invested in plants and stocks by Packard dealers who transact a gross business of $70,000,000 per year and employ 6455 workers. More than $11,000,000 of the gross investment is represented by buildings and $4,676,000 worth of building construction is now under way.

Simulates High Altitude

Liberty Motor on Test in Vacum Chamber Artificially Cooled

WASHINGTON, Oct. 2—One of the most interesting of all developments in connection with activities by the Government in the production of the new U. S. airplane is a small building at the Bureau of Standards grounds in which is a vacuum chamber for the testing of airplane engines at atmospheric conditions ranging from that found at sea level to that found at an altitude of 20,000 or more feet. In this chamber the engine can be started at sea level and "fly" as high as need be for observation purposes, and it can "land" as quickly or as slowly as desired.

The chamber is 6 by 6½ by 15 ft., with walls 12 in. thick, made of concrete and reinforced with steel, and not only is the reduction of pressure arranged for, but provision made to care for the exhaust of the engine. Provision also has been made for the heat produced by the engine which, in the open upper sky, would be dissipated. There is a mounting similar to that for an aeroplane, and the air left in the chamber is kept in rapid motion when tests are on.

One end of the chamber has big refrigeration coils, filled with ammonia, and five big fans provide the circulation. Openings in the side were made necessary for passage through them of water, ammonia, thermometer, pressure gages, and other devices. A shaft runs through a stuffing box to the outside to connect with an electric dynamometer, to observe the power up to 450 hp. The compartment is lined with cork, and the air that supplies the chamber must be brought in at a temperature to correspond with zero Fahr., which aviators find 20,000 ft. above the ground.

Surrounding the chamber is the stucco structure, 24 by 50 ft., containing the ammonia refrigerating plant, an exhaust blower with a capacity of 1500 cu. ft. a minute, weighing devices, measuring arrangements for estimating water and heat, including the heat which escapes in the water, the heat which escapes in exhaust gases, and also the heat that leaves the engine in the circulating air around it; also, for gaging the temperatures of air and water, for indicating the pressure of the air in the vacuum chamber, the volume of air used to supply the engine, the power and speed generated, and various other factors.

Doors leading into the chamber weigh 500 lb. each, and they are made so the covering will fall off in case of an explosion, that the chamber may not be wrecked. For observing the test, port holes, covered with glass an inch thick, are provided.

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Brass Makers Talk on Standardization

MILWAUKEE, WIS., Sept. 29 — The American Brass Manufacturers' Assn. held its semi-annual convention at Milwaukee on Sept. 27 and 29, and devoted most of its time to the discussion of the standardization of all kinds of brass goods. The association will simplify the number of patterns and the kinds of products and establish standards of interchangability. The changes are the result of the shortening supplies of material, the shortage of labor and high prices, and are being made as part of the general policy of the nation to eliminate all kinds of waste.

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French Airplanes Carry Wounded

PARIS, FRANCE, Sept. 26—Three tests made last Saturday of an airplane fitted with two stretchers for carrying wounded proved highly satisfactory. The tests took place at Villa Coublay. A physician and a corporal represented wounded passengers during a 12-minute flight, equivalent to a 15-mile journey.

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Packard, Pierce-Arrow and Locomobile in $21,000,000 Order

DETROIT, Sept. 28—It is reported that the Packard Motor Car Co. has received a large part of a $21,000,000 order for 5260 cars which is said to be divided between the Packard, Pierce-Arrow and Locomobile companies.

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Sweden to Conserve Gasoline Supplies

STOCKHOLM, Sept. 1—A royal decree has been issued in order to conserve Sweden's supply of gasoline and enforce economy in its use. According to this decree permission must be secured from the Industrial Commission for the use of gasoline.

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Parker Rust Proof Units for Europe

DETROIT, Sept. 29—The Parker Rust Proof Co. at the request of the United States Government is sending two complete Parker rust proofing units to Europe.

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Army Buys Side Cars

WASHINGTON, Oct. 2—The Quartermaster Corps of the Army has ordered 1000 Indian side cars, at a cost of $72 each, these attachments to be added to an equal number of motorcycles recently purchased.

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Trucks for Signal Corps for Aviation Work in Two Sizes

WASHINGTON, Oct. 1—Motor trucks used by the signal corps for aviation work will be quite different from the standard army war trucks. There will be two sizes, the light truck specifications which follow being complete. This truck will have a Continental C-2 engine, with a Monarch governor, disk clutch, Brown-Lipe and G. M. C. selective gearset, worm drive, semi-elliptic springs, wood wheels shod with pneumatic tires 35 by 5 in front and 28 by 7 rear. The price of the chassis is to be $2,040.72.

National Carbon In Big Merger

Prest-O-Lite, Union Carbide and Linde Air Products Included

CLEVELAND, Oct. 2—Stockholders of the National Carbon Co., Inc., are being notified formally of a plan for merging their company with other concerns in a deal which will mark one of the largest industrial combinations of the year—the merging of the Prest-O-Lite Co., National Carbon Co., Union Carbide Co. and the Linde Air Products Co. into a corporation with $3,000,000 shares of no par value stock. Holders of National Carbon common are offered one share of stock of the new company, which will be known as the Union Carbide & Carbon Corp., for one share of National Carbon company.

Figured academically on the current price of Carbon common, which is 76, the new concern's capitalization would be $228,000,000 at market figures.

Officers of the new corporation will be George O. Knapp, president; Edgar F. Price, M. J. Carney, and J. S. Crider, vice-presidents, Giles W. Mead, vice-president and treasurer, and H. E. Hackenberg, secretary. Myron T. Herrick will be chairman of the board of directors. Members of the directorate will include Andrew Squire, James Parmalee, C. K. G. Billings, Charles A. Coffin, J. J. Ricks, Nicholas F. Brady, G. W. Davidson, Conrad Hubert, Roger C. Sullivan, F. C. Walcott and James N. Wallace.

The new corporation will have plants in all parts of the country and will cooperate closely with the Government during the war. Its products will include automobile appliances, electric batteries, acetylene blow torches, lighting carbons and acetylene gas. The combination will also absorb the Oxweld-Acetylene Co., which is virtually controlled by the Union Carbide Co.

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Brewer-Titchener Will Control Five Plants

BINGHAMTON, N. Y., Oct. 1—Crandal-Stone & Co. has been merged with the Cortland Carriage Goods Co. and the Cortland Forging Co., both of Cortland, into a new corporation under the style Brewer-Titchener Corp. The company will control five plants, making drop forgings, metal stampings, bow sockets, step hangers, etc. Directors for the first year will be C. E. Titchener, B. M. Stannard, E. H. Brewer, E. A. Brewer, R. L. Brewer, F. L. Titchener, C. M. Devaney, M. C. Wood and R. P. Higgins.

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W. P. Wood, Pittsfield Coil Treasurer, Dead

PITTSFIELD, MASS., Sept. 29—W. P. Wood, treasurer and organizer of the Pittsfield Spark Coil Co. in 1904, died to-day. He was general manager up to the time of his death.

Automotive Issues Steady

United Motors Leads Market with 3⅛ Points Gain—Shorts Forced to Cover

NEW YORK, Oct. 2—Notwithstanding a general decline in prices in a majority of the automotive issues last week, the tone of the market was much improved. Just what effect the new tax will have on the automobile market is problematical, but if the covering by the shorts yesterday may be taken as a criterion, holders of stock may look forward to higher quotations. United Motors, which has been in a slump for some time, started climbing 2 weeks ago. Quotations on it yesterday reached 23⅜, just 3⅛ points higher than the previous week. The market was steady under pressure many times during the week.

Studebaker common rose 2¾ points; Portage common rose 3 points, and Willys-Overland preferred, ⅛ point. Losses ranged from a fraction to 6 points.

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Pathfinder Motor Co. Bankrupt

INDIANAPOLIS, Sept. 29—Too little capital has resulted in the appointment of a receiver for the Pathfinder Motor Co. of America. Operating on a capital of only $200,000, the company has been forced to borrow nearly $150,000, payment for which and claims from three creditors exceeding $10,000 have brought on the receivership. Charles Martindale, a local attorney, has become receiver.

The company has been operating for about 11 years and made a high-priced car selling at $3,250. There are about 5000 of these cars in use now.

The bankruptcy petition alleges that the company is insolvent and that its liabilities exceed $100,000. The company is charged with showing a preference for certain creditors during the last 4 months.

Last August this company succeeded the Pathfinder Motor Co. C. G. McCutcheon is president; F. C. Dorn, vice-president, and P. N. White, secretary and treasurer.

The action in the Federal Court follows closely a similar action in the Marion Superior Court of this city, when in answer to a petition for the appointment of a receiver the court named the Union Trust Co., Indianapolis, as receiver. The action in the Federal Court takes precedent over that in the local court.

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Receiver for Shotwell Pump

INDIANAPOLIS, Ind., Sept. 29—A receiver has been appointed for the Shotwell Pump and Tank Co., manufacturer of gasoline tanks and pumps, of this city, James M. Ogden, an attorney, being named receiver. Lax business methods are charged in handling the business affairs of the company.

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Chevrolet Shipments Increased 110 Per Cent

NEW YORK, Oct. 3—The Chevrolet Motor Co. reports shipments for the week ended Sept. 29 last of 3502 cars, as compared with 1664 cars in the corresponding week of the previous year, an increase of 1831 cars, or 110 per cent.

Stewart-Warner Earns 20%

1917 Business Has Enabled Company To Pay Off $100,000

CHICAGO, Sept. 28—Earnings of the Stewart-Warner Speedometer Corp. for the year ending Dec. 31 next are expected to equal at least 20 per cent on the common stock after allowing for excess profits tax, or practically 40 per cent of the current market price. Since Jan. 1, 1917, this company has paid off $100,000 of notes and probably will shortly pay a similar amount, thereby reducing the notes payable to $600,000.

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$1,760,504 Sales for Keystone Tire

ERIE, PA., Oct. 3—The Keystone Rubber Mfg. Co. for the quarter ending Sept. 30 last showed gross sales of $1,760,504. Net profits were $376,027, equal to more than 25 per cent on the company's outstanding stock.

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DIVIDENDS DECLARED

Detroit Iron & Steel Co. extra 5 per cent in addition to regular quarterly of 2½ per cent on the $1,500,000 common stock. Dividends aggregate $112,500 and are first paid since company increased its capitalization by 100 per cent stock dividend. There is also $750,000 preferred stock. Dividends are payable Oct. 5 to stock of record Sept. 15.

Stanley Motor Carriage Co., quarterly of 1¾ per cent on first preferred stock, payable Oct. 1 to stock of record Sept. 25.

Automobile Securities Quotations on the New York and Detroit Exchanges

	Bid	Asked	Net Ch'ge
*Ajax Rubber Co.	58	62	—2
*J. I. Case T. M. Co. pfd.	80	82	..
Chalmers Motor Co. com.	2	6	—1
Chalmers Motor Co. pfd.	..	..	..
*Chandler Motor Co.	73	75½	—3½
Chevrolet Motor Co.	77	80	..
Curtiss Aero	36½	38	—5½
*Fisher Body Corp. com.	..	35	..
*Fisher Body Corp. pfd.	84	87	..
Fisk Rubber Co. com.	63	67	..
Fisk Rubber Co. 1st pfd.	102	105	..
Fisk Rubber Co. 2nd pfd.	90	95	—6
Firestone Tire & Rubber Co. com.	112	115	—2½
Firestone Tire & Rubber Co. pfd.	101	104	—1
*General Motors Co. com.	95¼	95½	—2¾
*General Motors Co. pfd.	81½	83	— ½
*B. F. Goodrich Co. com.	42⅞	43⅜	—2⅜
*B. F. Goodrich Co. pfd.	100	102½	..
Goodyear Tire & Rubber Co. com.	187	191	—1
Goodyear Tire & Rubber Co. pfd.	101	103	—1½
Grant Motor Car Corp.	2	4	— ½
Hendee Mfg.	18	27	—2
Hupp Motor Car Corp. com.	2½	3½	— ¼
Hupp Motor Car Corp. pfd.	82	88	..
International Motor Co. com.	8	15	—3
International Motor Co. 1st pfd.	..	40	..
International Motor Co. 2nd pfd.	15	30	..
*Kelly-Springfield Tire Co. com.	42½	45	..
*Kelly-Springfield Tire Co. 1st pfd.	85	89	..
*Lee Rubber & Tire Corp.	17¾	18½	+ ½
*Maxwell Motor Co., Inc. com.	32½	32⅞	—2¼
*Maxwell Motor Co. Inc., 1st pfd.	64	67	—1
*Maxwell Motor Co., 2nd pfd.	20¼	20½	— ¼
Miller Rubber Co. com.	175	180	..
Miller Rubber Co. pfd.	100	102	..
Packard Motor Car Co. com.	143	148	—2
Packard Motor Car Co. pfd.	94	98	—2
Paige-Detroit Motor Car Co.	23	25	—1
Peerless Truck & Motor Corp.	10	12	—3
Portage Rubber Co. com.	123	126	+3
Regal Motor Car Co. pfd.	15	20	..
Reo Motor Car Co.	25	27	..
*Saxon Motor Car Corp.	12	14	—1
Springfield Body Corp. com.	..	..	..
Springfield Body Corp. pfd.	..	..	..
Standard Motor Construction Co.	9	10	+ ¼
*Stewart-Warner Speed. Corp.	63¾	64¼	—5¾
*Studebaker Corp. com.	44¼	45	+2¾
*Studebaker Corp. pfd.	..	90	..
Submarine Corp.	16½	17	—2½
Swinehart Tire & Rubber Co.	40	45	..
United Motors Corp.	23⅜	23⅝	+3⅛
*U. S. Rubber Co. com.	58½	58¾	—1¼
*U. S. Rubber Co. pfd.	103	104	— ⅛
*White Motor Co.	43	44	..
*Willys-Overland Co. com.	25½	25¾	—2¼
*Willys-Overland Co. pfd.	88	92	+ ¾
Wright-Martin	8⅝	8¾	+ ⅛

*At close October 1, 1917. Listed New York Stock Exchange.

OFFICIAL QUOTATIONS OF THE DETROIT STOCK EXCHANGE

ACTIVE STOCKS

	Bid	Asked	Net Ch'ge
Auto Body Co.	10½	11¼	..
Bower Roller Bearing Co.	28½	30½	—1
Chevrolet Motor Co.	..	80	..
Commerce Motor Car Co.	..	10	..
Continental Motor Co. com.	6⅜	6⅞	+ ⅜
Continental Motor Co. pfd.	..	..	..
Edmunds & Jones com.	..	..	..
Ford Motor Co. of Canada	214	218	+4
Hall Lamp Co.	18¾	20½	..
Michigan Stamping Co. com.	..	13⅜	..
Motor Products Co.	..	..	..
Packard Motor Car Co. com.	..	148	..
Packard Motor Car Co. pfd.	..	97	..
Paige-Detroit Motor Car Co.	..	24¾	..
Prudden Wheel Co.	16	19	..
Reo Motor Car Co.	25¾	26	— ⅜

INACTIVE STOCKS

Atlas Drop Forge	..	35½	..
Kelsey Wheel Co.	82	..	..
Regal Motor Car Co.	..	26½	..

U. S. Conserves by Export Ban

Long List of Articles Prohibited from Being Shipped—Export Licenses

WASHINGTON, Oct. 3—The exports administrative board has supplemented its list of articles which, their conservation being necessary if the war is to be successfully prosecuted, it has practically prohibited the exportation of, with the following:

Oil well casing, boring mills, vertical 42-in. and larger; lathes with 30-in. swing and larger; pleasure planers, metal working, 36-in wide and larger; caustic soda.

Commenting upon this order, the exports board said:

"Export licenses may be granted, however, for the above articles when destined for actual war purposes, or when they will directly contribute thereto; and in certain unusual cases when such exports will contribute directly to the immediate production of important commodities required by the United States; and also in certain other cases where the articles may be exported in limited quantities without detriment to this country, such as foodgrains and fats, which require the approval of the Food Administrator.

"Individual licenses will be required for shipments to Canada, Newfoundland and Mexico for all of the above-mentioned articles which are covered by railroad or ocean bill of lading dated on or after October 1, 1917. This date has been fixed in order to avoid interference with goods in transit."

Other articles on the conservation list are as follows:

Aluminum
Animal fats
Boring mills, vertical, 42" and larger
Castor oil and castor beans
Caustic soda
Chrome nickel steel
Cotton linters
Ferro-manganese
Ferro-silicon
Ferro-vanadium
Iron and steel plates, including ship, boiler, tank and other iron and steel plates ⅛ inch thick and heavier and wider than 6 inches, whether plain or fabricated
Lard
Lard compound
Lathes with 30" swing and larger
Nitric acid
Phosphoric acid
Phosphorus
Pig iron
Planers, metal working, 36" wide and larger
Potash and chlorate of potash
Potassium salts
Saltpetre
Scrap iron
Scrap steel
Searchlights and generators (suited for Army and Navy use)
Sodium sulphite
Steel billets
Sulphur and sulphuric acid
Tin plate
Tungsten
Vegetable oils
Wireless apparatus

Important Information for Shippers

In making this announcement, the Exports Administrative Board takes occasion to advise exporters and commission agents of the necessity of securing export licenses before making purchases for export or engaging freight space or tonnage for all articles on the conservation list. The granting of export licenses for the shipment of the food products and fats in the "Conservation List" (all commodities marked x) to countries other than those associated with the United States in the war is now being delayed; as, on the advice of the Food Administration, it is not desired to have any considerable quantities of the above articles exported. Heretofore, many applications have been made by telegraph, but this practice will not be necessary, if the above advice is followed, as telegraphic applications cannot receive a preference.

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Ford Accessory Show Big Success

CHICAGO, Oct. 1—The Ford accessory show held in the Coliseum all of last week, and which closed Saturday night, proved to be a successful business getter for the majority of the firms selling accessories to the jobbing trade. Many large exhibitors declared they were entirely satisfied with the business done during the week and did not know how they could have secured the same business at the same time.

Although the total attendance was but 51,039, and only 3 per cent of this was paid attendance, the remainder being by complimentary ticket, it is estimated by the management that one-half of the visitors came from outside of Chicago, and that from one-quarter to one-third of the total attendance represented the dealer and jobber interests. The remainder, or from 65 to 75 per cent, represented just attendance of people who could not be counted as potential buyers at the show.

Actual sales to jobbers were generally satisfactory. For example, the Chicago Pneumatic Tool Co. reports taking 100 orders on its kerosene generator, half of which business was to the jobbing trade and half to the owner trade. The Hassler Distributing Co. reports closing five contracts for its shock absorbers and selling many individual sets. Other concerns report similar contracts representing sums of money up to $300,000 or higher. It would scarcely be wise to quote many of these in detail as no attempt was made to verify the contracts.

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Final Settlement of Michigan Buggy

DETROIT, Oct. 3—The Michigan Buggy Co. bankruptcy is now in the final settlement stage with the final payment of 1 48-100 per cent made by the trustee in bankruptcy. This makes a total distribution to unsecured creditors of 23 per cent. The total receipts of the trustee were $845,736 and the unsecured claims were $2,560,231. The trustee continued the manufacture of automobiles until all the material was consumed.

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Atwater Kent Reduces Parts

PHILADELPHIA, Oct. 1—The Atwater Kent Mfg. Works has reduced by 50 per cent the price of contact springs and screws used in its types H, K2 and K3 ignition apparatus. All trade discounts remain as before. The change will not go into effect until Nov. 1 in so far as dealers and the general public are concerned. The reduction is made in the face of rising costs of materials and as a means to insure that purchasers get genuine parts instead of bogus parts which are inaccurate and of inferior quality.

Government Control for Steel Trade

150 Articles May Come Under Price Fixing to Affect Allies and Public

WASHINGTON, Oct. 3—Within a reasonable time, it may now be confidently stated, the entire steel trade is to be placed under government control as regards prices. This action will come, regardless of the fate of the Pomerene bill now before the Senate, which bill provides government control of iron and steel products. The difference, in the event the Pomerene bill should become law, would be that the Government would have specific authority to name the maximum price for every article in the iron and steel trade.

Should the Pomerene bill fail then the Government will enter into agreements, as in the case of the recent fixing of prices for plates, shapes, bars and pig iron, with manufacturers, and the War Industries Board will bind the latter to charge stipulated prices for about 150 articles. These prices also will apply not only to the United States Government, but likewise to the Allies and the general public.

All of the manufacturers were not parties to the agreement recently made as to prices on certain articles, but it is planned, it is understood, when additional agreements are entered into, to include all of them. Even with those already included, the question of quantity production, it is said, will enter very largely into the satisfactory carrying out of the agreements, as, if the Government will agree to take certain stipulated large quantities, then all well and good, the plants can be operated with a prospect even of a decrease below the prices fixed, in some instances. Should the manufacturers fail to get this assurance, and not be satisfied with the prices to the extent of failing to manufacture in sufficient quantities, then the Government could, and might exercise its authority and take over production.

Under rates fixed the prices of iron ore and coke have been left so high, these being the two principal ingredients of pig iron, that the big manufacturers who own their own ore mines, transportation lines, coke ovens and blast furnaces, will have a big advantage over the smaller or independent companies. For instance, the United States Steel Corporation, the Bethlehem Steel Co., the Jones & Laughlin Co., and other big manufacturers can, it is pointed out, sell easily at the Government's prices. The price of $6 a ton for coke is thought to be the most liberal allowance.

The larger manufacturers, however, as a rule, control their own coke supply. The price of $65 a ton for steel plates, though, is lower than was anticipated, and it had been predicted that the Government would allow as much as $70 in order to give the smaller manufacturer a good profit.

3% Tax Becomes a Law

Applies to Makers of Cars, Trucks and Motorcycles—Distributer Must Pay 1½% on Cars on Hand

WASHINGTON, D. C., Sept. 30—Automobiles and motorcycles will have to pay a 3 per cent war tax, and motorboats 5 per cent.

The War Revenue Bill has passed both the Senate and the House practically unanimously, and probably will be a law by the time this issue of AUTOMOTIVE INDUSTRIES reaches its readers.

This 3 per cent tax is to be paid by manufacturers on the price of the vehicle as sold to the distributer. This means that manufacturers of automobiles, trucks, motorcycles and motorboats will be held responsible by the Government for this tax. As mentioned last week, it has been suggested by the Conference Committee in Washington that this tax be passed on to the wholesaler or dealer and that he in turn will pass it on to the consumer. It is certain the consumer will have to pay it but it is not known whether he will pay it as a special war tax, or in the form of an increased price on the vehicle. As prices have been increasing very much during the past year and sales diminishing, it is questionable if prices will be raised, as that in all probability the revenue will come as a war tax.

Automobiles, motorcycles, motor trucks and motor boats in the hands of retailers when this war tax goes into effect will be exempt. Such vehicles held by wholesalers will be subject to a tax of 1½ per cent.

Applies Only to New Cars

The tax measure applies only to new cars and motor trucks and though the wholesaler who has cars on hand must pay a tax of 1½ per cent the tax will not affect used cars held by dealers, according to General Manager Reeves of the National Automobile Chamber of Commerce.

From the amount of tax to be paid on each vehicle the manufacturer may deduct 5 per cent of the amount paid for the tires, including inner tubes. Following are the particular sections of the measure which affect the automotive industry:

SECTION 600—That there shall be levied, assessed, collected and paid

(a) Upon all automobiles, automobile trucks, automobile wagons, and motorcycles sold by the manufacturer, producer, or importer, a tax equivalent to 3 per centum of the price for which so sold.

SECTION 602—That each manufacturer, producer, or importer of the articles enumerated in section six hundred and one (Sporting Goods Division) shall make monthly returns under oath in duplicate, and pay the taxes imposed on such articles by this title to the collector of internal revenue for the district in which is located the principal place of business. Such returns shall contain such information and be made at such times and in such manner as the Commissioner of Internal Revenue, with the approval of the Secretary of the Treasury, may by regulations prescribe.

Nothing in this section shall be construed to impose a tax upon articles sold and delivered prior to May 9th, 1917, where the title is reserved in the vendor as security for the payment of the purchase money.

Title X.—Administrative Provisions

SECTION 1007—That (a) if any person, corporation, partnership, or association has prior to May 9th, 1917, made a bona fide contract with a dealer for the sale, after the tax takes effect, of any article upon which a tax is imposed under Title III, IV, VI (covering tax on automobiles), or IX, or under subdivision fourteen of Schedule A of Title VIII, or under this section, and (b) if such contract does not permit the adding of the whole of such tax to the amount to be paid under such contract, then the vendee shall, in lieu of the vendor, pay so much of such tax as is not so permitted to be added to the contract price.

The taxes payable by the vendee under this section shall be paid by the vendor at the time the sale is consummated, and collected, returned and paid to the United States by such vendor in the same manner as provided in section 503.

The term "dealer" as used in this section includes a vendee who purchases any article with intent to use it in the manufacture or production of another article intended for sale.

The present situation leaves it up to the automobile retailer to secure the tax. This is the case unless the manufacturers generally increase their prices to provide for it. Should the manufacturers not do this then the distributers and the retailers will undoubtedly be called upon by the manufacturer to provide the tax. Naturally the manufacturer will bill the dealer. The dealer will have to sell the car at an increased price or sell it at the low price with a special war tax added.

Consumer Affected

The difference in price to the consumer will range from $10 up. On a car that a dealer buys for $800, the war tax will be $24. On a car the dealer buys for $2,000 the tax will be $60.

The present tax of 3 per cent which was finally adopted is really a compromise by the Conference Committee. The Ways and Means Committee of the House which started drafting this war measure first determined upon a 5 per cent tax. The Senate would not agree to such. The Senate Finance Committee, a committee of the Senate which had to draft a revised tax, did not favor taxing manufacturers but proposed a federal license tax on all cars in the hands of owners. The two committees when they met in conference would not agree on either and as a result the 3 per cent manufacturers' tax stands as a compromise.

It is generally rumored here that the House representatives on the Conference Committee were opposed to the federal registration tax on the ground that it might influence the voters whereas if the matter were passed on to manufacturers such would not be the case. It does seem as if the present method is a new way of chasing around the bush, and that while there will not be a federal license tax the car owner will have to pay the bill.

It cannot be conceived why a tax should be placed on motor trucks. The members of the Conference Committee declared that the present 3 per cent tax is purely discriminatory. They declare that revenue is needed and that taxing trucks is a possible source of revenue. It seems as if those on the Conference Committee consider motor trucks a luxury. As it is, trucks, automobiles, motorcycles, and motor boats have been classed with talking machines, cosmetics, jewelry, motion pictures, etc. There are other lines of goods that are similarly taxed such as musical instruments, motion picture films, sporting goods, cameras. Chewing gum is let off easier with a 2 per cent tax, perfumes are taxed but 2 per cent. On the other hand all other types of transportation, such as bicycles, horse carriages, horse wagons, and in fact everything else, is exempted.

Effect of Tax on Industry

Detroit manufacturers do not believe that the new tax will have an important effect on the automobile industry although they anticipate a slight decrease in business which always follows an increase in cost. None of the manufacturers has arranged definitely the plan of procedure following the passing of the law, but the general impression is that all manufacturers will pass the tax on to the consumer through the distributer and the dealer, allowing the dealer either to add to his selling price or to add separately to the transaction sufficient to include the cost of the tax. The Ford company anticipates some such plan as this but can not say definitely what it will do until Ford officials hold a conference this week. The Buick company will hold a conference later in the week to decide upon its plan. Neither Chalmers or Maxwell have made any arrangements to care for the increase and will be unable to provide for it through the present prices, but anticipate that the tax will be passed on to the consumer through the distributer and dealer. The Paige company has arranged with dealers through contract made in the past six months by which the dealer will have to care for any tax imposed and can at his option pass it on to the consumer. Hudson, Packard, Reo, and all other concerns take the same view of passing the tax on to the consumer. Many of the executives of these concerns believe that the tax will be a menace to dealers inasmuch as many dealers will sacrifice part of the tax cost in the effort to sell the cars, and all manufacturers take the view that the tax should have been placed directly on the motorists of the nation rather than the indirect tax now contemplated.

There are between 70,000 and 100,000 cars in the hands of dealers and distributers throughout the country on which the tax of 1½ per cent is applicable.

Oil Production Is Growing

Statistics Show Gratifying Increase from Many Fields—Gaining on Consumption

WASHINGTON, Oct. 3—The table below issued by the Bureau of Mines shows that oil production has increased largely and is now slightly more than enough to offset consumption, North Louisiana being the only field which has not bettered its condition. Stocks on hand are still lower than the average of a year ago, but the condition is quite encouraging.

The tabulation below differs from preceding summaries of this series in that the statistics of deliveries to trade are computed from those of oil moved from field sources and of stocks, instead of being compiled directly from the reports of co-operating companies; and the statistics of stocks are arranged by grade of oil involved, instead of by geographic position, Mid-Continent oil held by Eastern pipe line companies, for example, being tabulated with similar oil held in Oklahoma and Kansas, instead of with Appalachian stocks, as in preceding summaries.

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$50,000,000 in Orders Held by Curtiss Aeroplane

BUFFALO, Sept. 28—The Curtiss Aeroplane & Motor Corp., it is stated, has now considerably in excess of $50,000,000 orders on its books. The new Curtiss plant will be completed within a few weeks. About 700,000 of the 1,200,000 sq. ft. of space planned is already under roof. It is learned that the corporation investment in this new plant will be about $4,000,000, exclusive of machinery. The total capital investment by the Curtiss corporation at Buffalo during 1917 represents between $6,500,000 and $7,000,000, representing both buildings and materials. The new plant, covering space equivalent to 100 ft. wide and 2½ miles long, will be devoted exclusively to the manufacture of planes.

Additional space in the old plants has, however, been obtained by removal of the development and experimental plant to Garden City, L. I., where a plot of 20 acres has been secured adjoining the Mineola flying field.

A new corporation has been organized, financed and started in business known as the Curtiss Engineering Corp., which will handle all the development and experimental work of the Curtiss corporation at the new Garden City plant. The plant, when completed, will represent an investment of $500,000. G. H. Curtiss is president of the new corporation.

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Weger to Build Airplane Motors

CLEVELAND, Sept. 28—The Weger Aeronautical Motor Co. has been incorporated here with a capital of $200,000. The company is allied with the Weger Motor Co., which owns patents on motors that can be used for aeronautical purposes. Arrangements have been made for royalty payments to the Weger Motor Co. A. L. Hammink is president of the aircraft company, C. B. Cortlett is vice-president and S. G. Fleisher is secretary and treasurer. These with H. H. Brelsford and E. V. Raus comprise the directors.

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Stelling to Build Planes

SAN FRANCISCO, CAL., Sept. 20—James H. Stelling, of the Arnold Stelling Co., Inc., distributers of Simplex cars, has secured an airplane factory in Oakland, which has a capacity for three planes per week. Arrangements are being made to secure government work. The plant is known as the Christoffersen and was built in 1912 by Silas Christoffersen, who was killed last November.

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Daniels to Make Master Primer

DETROIT, Sept. 28—E. T. Daniels, secretary of the Master Carburetor Corp., is incorporating a new concern which has purchased the patents covering the primer which the Master company has been marketing and which has already been adopted by the Franklin Automobile Co. as standard equipment. The company will organize and erect a factory in Detroit.

Crude Petroleum Delivered to Refineries or Consumers

(Barrels of 42 gal. each.)

Field	August, 1917	July, 1917	August, 1916
Appalachian	2,064,377	2,138,844	2,104,819
Lima-Indiana	337,799	395,228	194,905
Illinois	1,731,755	1,659,969	1,810,210
Oklahoma-Kansas	12,629,756	12,021,800	10,762,506
Central and North Texas	960,322	879,446	1,318,273
North Louisiana	861,660	1,120,586	1,010,492
Gulf Coast	2,357,228	1,725,789	1,405,206
Rocky Mountain	811,796	820,966	490,108

Stocks of Crude Petroleum at End of Month

(Barrels of 42 gal. each.)

Field	August, 1917	July, 1917	August, 1916
Appalachian	4,366,178	4,304,151	4,337,193
Lima-Indiana	2,171,119	2,216,626	2,483,681
Illinois	3,927,285	4,285,453	7,464,016
Oklahoma-Kansas	100,547,961	100,520,594	99,248,762
Central and North Texas	3,006,649	2,955,385	5,063,665
North Louisiana	3,671,940	3,682,082	4,498,148
Gulf Coast	7,692,649	8,336,082	8,731,032
Rocky Mountain	636,590	690,246	691,883

Statistics of petroleum movement in California are not included in this tabulation because of delays incident to procuring first-hand data.

Use of Gasoline in Great Britain

Commercial Vehicles Biggest Consumers, 37 Per Cent—Industrials, 18 Per Cent

LONDON, Sept. 15—Many people have been wondering just who have been the biggest users of gasoline in England under the present licensing system. Some newspapers had been arguing that private motor cars were using too great a percentage and that there was too much joy-riding for war times. To answer the situation the president of the Board of Trade which has this matter in hand has made an official investigation and his report shows that only 9 per cent of the fuel is consumed by private motor cars which includes all private cars employed on government work and those in connection with munition factories.

The report shows that commercial vehicles use 37 per cent; hackney vehicles, which include buses and taxicabs, 30 per cent; industrial processes, 18 per cent; doctors and veterinary surgeon cars, 5 per cent.

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Wright-Martin Dividend in 6 Months

DAYTON, OHIO, Oct. 1—It is expected that the Wright-Martin Aircraft Co. will start to pay dividends on its $5,000,000 preferred stock before the middle of next year. The company has almost completed its French contracts, on which the loss is estimated at $400,000. The contract with the United States Government, however, is expected to show a substantial profit, larger than the loss on the French contracts. The company has $2,000,000 in cash, owes no money, and its plant and equipment of $5,000,000 are paid for. The reason for expecting a dividend is that within the next 6 months the company will receive about $2,500,000 for payments of Wright patents and for the profits on Government work.

—

1000-Mile Non-Stop Flight

TURIN, ITALY, Sept. 22—In a test flight with a new army biplane, Captain Julius Laureati has established a world's non-stop record by flying from Turin to Naples and return. The round trip is a distance of nearly 1000 miles, which was covered in exactly 10 hours 30 minutes, giving an average speed of more than 90 miles an hour. Captain Laureati made this flight under unfavorable weather conditions in a Sia biplane fitted with a new Fiat 300 hp. water-cooled motor. The test is considered a remarkable proof of the reliability of the Fiat engine and of the efficiency of the new aeroplane.

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Ford on Special Financial Committee

DETROIT, Oct. 2—Henry Ford has been appointed to a special committee by Secretary of the Treasury McAdoo to aid in the floating of $2,000,000,000 of war saving certificates just authorized by Congress.

Industrial Review of the Week

A Summary of Major Developments in Other Fields

NEW YORK, Oct. 3—Changes in the fuel and power situation held the center of the industrial stage during the past week with the fixing of retail prices of coal playing the most prominent part. Reports from the *U. S. Geological Survey* show that the coke shortage occasioned by lack of cars to move it is being reduced, figures collected by the *Electrical World* indicate a big growth in the central power station industry, and *Coal Age* indicates that the bituminous situation grows more acute daily.

Anthracite Prices Reduced

The Fuel Administration authorizes the following: Reductions have been ordered in the price at which Pennsylvania anthracite pea coal may be sold f.o.b. the mines. Hereafter the maximum f.o.b. mine prices in the several fields will be as follows: White Ash, $3.40; Red Ash, $3.50; Lykens Valley, $3.75. Producers to whom a differential of not to exceed 75 cents was permitted in the President's order of Aug. 23 may continue to add the same differential to the above prices.

H. A. Garfield, Fuel Administrator, has issued an order describing the method by which retail coal and coke dealers shall fix their maximum gross margins, viz., the difference between the average cost of coal or coke at the retailer's yard, wharf, or siding, and the price at which they sell it to the consumer. Under the plan announced, the retailer ascertains his retail margin in the year 1915, when more normal conditions prevailed than at present. To this he may add not to exceed 30 per cent of that margin, which, of course, includes his profits at that time. It is provided, however, that in no case shall the gross margin added by any retail dealer exceed the retail margin added by him during July, 1917.—*Official Bulletin.*

Coke Moving More Rapidly

There is an apparent improvement in the supply of cars for transporting coke. The percentage of full-time output lost on account of car shortage by all mines reporting dropped from 10.3 per cent during the early part of September to 6.3 during the latter part. Every district reporting exhibited a better car supply except the Freeport Thick and Thin Veins and the Winding Gulf regions. The extraordinary reduction in the losses due to car shortage in Ohio, 18.4 to 5.6 per cent, and in the Pittsburgh district, 10.1 to 5.8 per cent, may be attributed in part to the priority order giving preference to shipments of coal to the Lakes.—*U. S. Geological Survey.*

Bituminous Situation Worse

The bituminous situation is in a critical condition which is rapidly merging on a desperate one. Mills, factories, industrial and municipal plants everywhere, unless their needs are covered by contracts made prior to price-fixing by the Government, are in short supply of fuel. Many are unable to run except by borrowing coal from their more fortunate neighbors. Some plants are down to a supply scarcely in excess of 24 hr. requirements. Such conditions have seldom, if ever, been known before. Many consumers of fuel are willing and anxious to pay prices much above those established by the Government. Producers, mining coal which costs them f.o.b. cars slightly more than the Government schedule, are anxious to dispose of this fuel at a price which will not net them a loss; but these two elements are unable to get together and do business because of the edict from Washington which forbids transactions other than on the Government basis. The conditions over the entire country are such that unless price readjustments are made soon the result will be disastrous and far reaching.—*Coal Age.*

A New Service

¶Herewith THE AUTOMOBILE AND AUTOMOTIVE INDUSTRIES *supplies for the benefit of its readers a general summary of important developments in other fields of business. This is rendered possible by the editorial cooperation of leading industrial publications which are recognized authorities.*

By compressing the general industrial situation into this form we hope to give our readers a clear and comprehensive idea of up-to-the-minute developments which they could otherwise secure only with considerable expenditure of time and effort.

Central Stations Show Gains

Statistics of the central station industry gathered by this paper show that there was a larger growth in earnings over the corresponding months in 1916 than have been shown by the previous months of this year. The increase is attributed to the higher prices charged because of the rising fuel costs. The output of energy from the central stations is now more than double what it was before the opening of the European war.—*Electrical World.*

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Stutz to Concentrate on 16-Valve Engine

INDIANAPOLIS, Oct. 1—The Stutz Motor Car Co. will concentrate on the 16-valve, 4-cylinder, T-head engine which will be used on four new models this coming season. The eight-valve engine offered optionally last year has been dropped.

The four models are: the Bearcat on a 120-in. wheelbase, at $2,550; the roadster at $2,550, formerly $2,375; the four-passenger, $2,650, an increase of $100; and the six-passenger, $2,750 instead of $2,550. The last three have a wheelbase of 130-in.

The cylinders are 4⅜ by 6 and are block cast. Fuel is pressure fed. Other features include Stromberg carbureter, separate Remy units for starting and lighting, and high-tension magneto for ignition.

Body changes show marked departures from the last series. The bodies have a smoother outline, the hood and radiator shapes have been changed and the double cowl in the four and six-passenger models has been removed.

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Disagree on Ford Price Fixing

CINCINNATI, Sept. 25—The Ford Motor Co. was restrained from setting a price by which Ford cars are to be retailed when the United States Circuit Court of Appeals yesterday filed a mandate and opinion in the appeal of the Ford Motor Co. versus the Union Motor Sales Co., et al., Dayton, Ohio, in the United States District Court, in which the court affirmed the decree of the United States District Court. Judge Hollister dismissed the Ford company's suit against the Union company, in which Ford sought to restrain the Union company from selling Ford automobiles at prices below the standard fixed by the company.

This decision is just the opposite of that rendered in the United States Circuit Court of Appeals for the Ninth Circuit at San Francisco, in which it was held that the Ford company is within its rights in compelling its dealers to sign contracts agreeing to sell Fords in a restricted territory and at an established price.

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Cassco Engine Pump on Oakland

NEW YORK, Oct. 3—The Oakland Motor Car Co. has placed a special equipment contract with the Edward A. Cassidy Co. for 10,000 Cassco engine driven tire pumps.

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Ford's Boston Plant to Be Used

BOSTON, Oct. 3—Notwithstanding reports to the contrary, the Ford assembling plant in Cambridge will be used by the Government. The question of taking care of the employees has been solved. Henry Ford has been in Cambridge and has completed arrangements to turn over his plant there to the War Department. All workers from that plant are being transferred to other Ford plants. This plant will be operated on a bigger scale after the war is over. The New England trade will be taken care of from other Eastern and Southern plants until some other arrangements can be made.

New Simplex Tractor Uses Kerosene Fuel

WICHITA, KAN., Sept. 28—The Simplex Tractor Co. has been incorporated here with a capital of $300,000 and will erect a plant and manufacture 1000 farm tractors per year. Many orders have already been received from various foreign markets. Incorporators include James P. Sullivan, O. D. Barnes, R. C. Fisher, W. Magill, C. Franks, F. O. Stone, I. N. Williams, Henry Bockelman and A. E. Alport. The Simplex tractor burns kerosene and uses one lever for control, which has two forward speeds and one reverse.

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MILWAUKEE, WIS., Sept. 29 — The Western Rope & Mfg. Co., 325-333 Robinson building, Tulsa, Okla., one of the largest manufacturers of oil well equipment in the country, has purchased the plant of the Schneck Machine Co., 809-811 St. Paul Avenue, Milwaukee, and proposes to spend between $200,000 and $250,000 in enlarging the works and making it the main plant. The Schneck shop has been manufacturing and jobbing special machinery, but is now being equipped especially for the manufacture of gasoline engines, tanks, boilers and other equipment for oil fields. The purchase includes much additional vacant acreage near the Schneck plant, which will be utilized for the erection of important extensions immediately. B. M. Gessel is president and general manager and will make his headquarters in Milwaukee. The plant at Tulsa will be continued as before, with gradual enlargements.

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GREEN BAY, WIS., Sept. 29—Articles of incorporation have been filed in behalf of the Crank Shaft Valve Movement Corp., this city, with an authorized capital stock of $300,000. The company will manufacture and market motors, engines and other machines employing a new type of valve operating mechanism designed by Green Bay engineers. Further details concerning the project will be announced later, it is stated. The promoters of the new company include Sylvester Duquaine, A. L. Cannard, Jules Gerard, Julian Cannard and John Findeisen.

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RACINE, WIS., Sept. 29—The Wohlrab Gear Co. has been incorporated at Racine, Wis., with a capital stock of $75,000 by Paul B. Wohlrab and Charles Kreuzke to manufacture gears and other parts for cars, trucks, tractors and other machinery.

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PHILADELPHIA, Sept. 28—The Atlantic Auto Radiator Co. has been incorporated in Delaware with a capital of $50,000 to manufacture automobile parts. Harry G. Goodman, Joseph Carmin and C. M. Hogarth are the incorporators.

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CLEVELAND, Sept. 28 — The Dann Spring Insert Co. has formed a Canadian company under the name of the Dann Spring Insert, Ltd., at Hamilton, Ont., to manufacture accessories and parts for the car industry. The capital is $40,000. Incorporators include George R. Harvey, Cecil V. Langs, E. G. Binkley and others.

New Companies

Pneumatic Car Brake Designed by Deering

MADISON, WIS., Sept. 29—August Deering, of the Deering Boat Mfg. Co., has perfected a new type of pneumatic brake for motor vehicles upon which he will apply for patents before making definite arrangements for its production. The brake is controlled from the steering wheel in a manner similar to the spark and gas controls, and is operated by compressed air. It is likely that a company will be organized to manufacture the device at Madison.

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INDIANAPOLIS, Sept. 29—The Standard Ignition Co., Elkhart, Ind., was incorporated last week with a capitalization of $200,000, to manufacture magnetos, automobile parts and electrical devices. Several prominent manufacturers are interested in the company, which plans to begin production as soon as possible. The incorporators of the company are Andrew H. Beardsley, Martin E. Crow, William H. Foster, John F. O. Stratton, and Edward H. Zigler.

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INDIANAPOLIS, Sept. 29—The Acme Convertible Body Co., of this city, has been incorporated with a capitalization of $10,000, to manufacture convertible bodies for cars. Directors of the company are Joseph Butterworth, Edward Marosky, Henry Marosky and Richard A. Gahr.

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LOS ANGELES, CAL., Sept. 25—The Community Mfg. Co. has been organized here with a capital of $3,000,000 to manufacture farm tractors and commercial trucks. E. G. Judah, president of the Merchants and Manufacturers Assn., heads the new enterprise, which will have its plant at Burbank.

Ford Challenged by Overland

(*Continued from page* 600)

Overland radiator although of slightly smaller size, ties this new machine up with the Overland line, so far as appearance is concerned. The body is a streamline design with removable upholstery.

The engine is 3½ in. by 4 in. and reaches the peak of its power curve at 2000 r.p.m. Though it is 13 per cent smaller than the Ford motor it is stated to produce 52 per cent more power, since the Ford engine peaks at 1200. The transmission is a two speed sliding gear and a conventional clutch is used. An entirely original sort of frame is used, and the cross members are supplied by the running board supports, which are further stiffened by the steel battery box that lies just inside the frame under the front seat. The gasoline tank is hung under the cowl on a three point suspension. All the control is centralized on the middle of the dash and comprises ignition switch, lamp dimmer and throttle setting for idling together with the choke. Front and rear axles are somewhat similar to Ford's, but the latter has ball bearings.

The fenders are crowned, the front ones being pressed in such shape as to combine with the hood ledge, there are exceptionally wide fore doors, a sixteen inch steering wheel and a slanting windshield. A one man top completes the equipment.

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69,986 Fords in September

DETROIT, Oct. 3—The Ford Motor Co. produced 69,986 cars in September. This is an increase of 17,267 over September, 1916.

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Argentine Buyers Want American Cars

NEW YORK, Oct. 1—S. H. Hirsch & Co., 82 Wall Street, purchasing agents for automobile concerns in Spanish-American countries, announce that representatives of one of its clients, which is the leading distributer of automobile supplies in Argentina, will arrive in this city shortly for the purpose of placing orders for automobile supplies. This concern previously handled European cars and supplies, and for the last year has switched its trade to the United States, acting as distributing agents for Argentina and Uruguay. All proposals will be received at the office of the purchasing agents, 82 Wall Street.

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Naval Bulletin Deals With Submarine and Kindred Problems

NEW YORK, Oct. 1—The first of a series of proposed bulletins has been issued by the Naval Consulting Board and deals with the submarine and kindred problems. It explains the situation with regard to the submarine menace and deals with some fundamental scientific facts which do not seem to be familiar to inventors that have sent in proposed solutions of the problem. The subject matter is handled under the following headings: Electric Magnets and Magnetism; Electrical Effects in General; Protection Against Submarine Attack; Mines and Torpedoes for Naval Operations; Confining the Submarines, and Ships and Shipbuilding. General instructions to those offering suggestions to the Naval Consulting Board conclude the bulletin, which is issued from the office of the secretary at 13 Park Row, New York.

Kelly-Springfield's Plant to Cost $5,000,000

CUMBERLAND, MD., Oct. 1—An investment of $5,000,000 is provided for in the final plans of the Kelly-Springfield Tire Co., Akron, for the plant it intends to build here, instead of the $2,250,000 factory mentioned in the early part of the year. The $5,000,000 will be invested in improvements, buildings, machinery, etc., the manufacturing facilities now planned contemplating an annual capacity of over 400,000 tons of automobile tires and other similar supplies. The tire capacity alone will range from 4000 to 5000 a day.

The main building will be 900 ft. long and 700 ft. wide, but its construction will not be started until next May. It will be more than twice the size of the main structure as originally planned. Construction will soon begin on the power-house, machine shop, pump-house, water-works building and a garage.

The land improvements include building a complete industrial city with modern dwellings equipped throughout for comfort and convenience.

A site of 75 acres will be occupied by the plant, and during its first year of operation 3000 men are to be employed, this number to be increased to 5000 during the second year and to 10,000 later.

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Chevrolet Engineers in New York

FLINT, MICH., Sept. 28—The engineering department of the Chevrolet Motor Co., formerly located with the Mason Motor Co. in this city, is being moved to New York and will be located at 618 West Fifty-sixth Street. Hereafter all engineering correspondence should be sent to the latter address, as should also samples for approval of all parts manufactured for Chevrolet cars, with the exception of sample castings and forgings for motors and axles, the design of which has been approved, which may be sent to the Mason Motor Co.

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New G. M. Drop Forge Plant

DETROIT, Sept. 28—The General Motors Co. has completed plans for the construction of a new drop forge plant to cost about $300,000, and consisting of three one-story buildings, 160 by 600 ft., 75 by 600 ft. and 65 by 300 ft. It is also arranging for the erection of a new factory in Flint, Mich.

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Flint Makers Retain Eastern Time

FLINT, MICH., Oct. 1—The Flint Manufacturers' Assn. has decided to retain eastern time in all of the factories despite the fact that the common council adopted eastern time for the city only for the months of July, August and September.

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Moreland's $500,000 Plant Started

BURBANK, CAL., Sept. 28—The Moreland Truck Co., Los Angeles, has started the erection of the first unit of its new plant at Burbank. The new works, to cost over $500,000, will be devoted in part to the manufacture of tractors of both high wheel and caterpillar types suitable for light and heavy work ranging from 30 to 75 hp.

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Factory

Cleveland Plow Enlarges

CLEVELAND, Sept. 28—The Cleveland Motor Plow Co. has changed its name to the Cleveland Tractor Co. and is arranging plans to increase the capital stock from $600,000 to $6,000,000. Six hundred thousand dollars of the new stock will be issued now, making $1,200,000 outstanding. It is anticipated that the greatest part of the new stock will be taken by the present stockholders at par. F. H. Goff, a director of the company, says: "Additions are being built which will give the company a capacity for 8000 tractors next year."

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$500,000 Plant for Buhl Stamping

DETROIT, Oct. 1—The Buhl Stamping Co. is building a $500,000 plant which will open shortly and contains 6 acres of floor space.

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Anderson Model 79 Being Shipped

DETROIT, Oct. 1—The Anderson Electric Car Co. has begun shipment of its new model 79, which is especially designed for use by men.

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Security Tire Plant for Wellington

WELLINGTON, OHIO, Sept. 28—The Security Tire & Rubber Co., Cleveland, will build a plant at this city, where it will manufacture its products. The company makes a tire that does not require inflation. The concern is capitalized for $1,000,000.

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Saginaw Iron Starts Working

SAGINAW, MICH., Sept. 29—The Saginaw Malleable Iron Co. will place its first furnace in operation and melt the first metal in its new plant this week. At present none of the departments are completed but the construction has reached the point where operations will be started shortly. Skilled moulders are sought.

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Lane's First Truck Built

KALAMAZOO, MICH., Sept. 29—The Lane Truck Co. has constructed its first 3-ton truck.

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Sutherland Tool Moves to Flint

GREENVILLE, MICH., Sept. 29—The Sutherland Tool Co. is moving from Greenville to Flint, where it has a large factory.

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100 Saxons a Day

DETROIT, Sept. 29—The Saxon Motor Car Corp. is now producing 100 cars per day and has a large number of unfinished orders on hand.

Women Core-Makers in Aluminum Castings Plant

MANITOWOC, WIS., Sept. 29—Twenty-five young women were placed at work as core-makers in the big foundry of the Aluminum Castings Co. during the week as an experiment in overcoming the serious shortage of male help. The demands of the war have been depleting the ranks of male employees and the only alternative is to hire girls and young women. It is stated that the Aluminum Castings Co. will try the experiment in its numerous other foundries throughout the country, all of which are facing a similar situation. The company is one of the largest producers of car castings in the world.

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Big Accessory Plant for Milwaukee

MILWAUKEE, WIS., Sept. 29—A recurrence of well founded reports that a large accessory concern with headquarters at Detroit and branch works at Cleveland will establish a big plant in Milwaukee has resulted from the filing of a petition for the vacation of a part of Keefe Avenue from Twenty-seventh Street to the Milwaukee road tracks, at the extreme northwestern city limits of Milwaukee. About a year ago outside interests, said to be represented by W. J. Zimmers, a Milwaukee attorney, started to purchase acreage in the vicinity of the plant of the A. O. Smith Corp., Milwaukee, and these holdings now aggregate from 15 to 20 acres. Surveyors have been at work on the site for several days, and it is believed that it is planned to break ground before the end of the year. No intimation is given relative to the name of the concern and Milwaukee men who admit they are interested in the project steadfastly decline to divulge details, being subject to strict orders from their clients.

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Carlisle Tire Plant Working

NEW YORK, Oct. 1—The Carlisle Cord Tire Co., which was formed a short time ago and has its factory in Andover, Mass., is now in active production. Representation has been arranged in a large number of cities.

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1000 Buicks for Frisco

SAN FRANCISCO, CAL., Oct. 1—Five solid trainloads of Buicks, including more than 1000 cars all on the way at one time and all consigned to the Howard Automobile Co., San Francisco, arrived here last week.

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Triangle Truck Adds

ST. JOHNS, MICH., Sept. 28—The Triangle Motor Truck Co. will erect an addition to its plant which will be 70 ft. by 235 ft. and one-story high. The structure will cost $15,000.

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Elgin to Increase Factory Work

CHICAGO, Oct. 1—The Elgin Motor Car Corp. turned out 806 cars during August, as against 724 for the season of 1916. The factory is now rushed and plans for new factory buildings which

are now in process of construction will have to be increased. With the completion of the present buildings the capacity of the plant will be more than 100 cars per day. The present output is forty cars per day.

New Paige Plant for Assembling

DETROIT, Sept. 29—The Paige Motor Car Corp. will use the four-story building and basement, which it recently acquired from the Williams Brothers Pickling Co., for assembling of closed cars and for chassis and final assembly work.

$25,000 Addition for Johnson

RACINE, WIS., Sept. 29—S. C. Johnson & Son, manufacturers of a variety of polishes, pastes, carbon removers and chemical compounds for the car trade, will erect a $25,000 addition to their plant, both for manufacturing and warehouse purposes. Contracts have been awarded and work will begin at once.

Timken-Detroit Axle Adds

DETROIT, Sept. 28—The Timken-Detroit Axle Co. is building a one-story steel frame storage building 50 by 108 ft.

120 Sterns Tubes Daily

ST. LOUIS, MO., Sept. 30—The Sterns Tire and Tube Co. has reached an output of 120 Sterns tubes. This has been accomplished with machinery which has been removed here within the last few weeks from the experimental factory at Marion, Ohio, which has been closed. New machinery has been ordered to increase the output to 200 tubes daily by Dec. 1. Still greater increases are planned later.

The Sterns Tire and Tube Co. was organized in this city two years ago by F. B. Sterns, inventor of the reinforced tube that attracted much attention by reason of the tests made for it. The company has been twice reorganized. In the first overturn, F. B. Sterns, the inventor, was dropped. Now comes a second reorganization by which Mr. Burgess, formerly with the Goodyear Rubber Co., and later sales manager for the Dorris Motor Car Co., of this city, becomes president. Otto M. Mensing is vice-president and Charles K. Koch, secretary-treasurer. Of his company President Burgess says:

"This company will have a $1,000,000 capital, plenty of assets and not a cent of liability. We have demonstrated our tubes to distributers and we have contracts for more than $350,000 closed, which represented 85 per cent of the territory in this country. Our Canadian branch has been doing a flourishing business for several months."

Calendar

ASSOCIATIONS

Oct. 9-11—Pittsburgh National Assn. of Purchasing Agts. Convention.
Oct. 9-11—Chicago, National Federation of Implement and Vehicle Dealers' Assn., 18th Annual Convention, Hotel Sherman.

1918

Jan. 3-4—New York, Automotive Electric Assn., meeting.

CONTESTS

Oct. 6—Danbury, Conn., Track Race.
Oct. 6—Uniontown, Pa., Speedway Race.
Oct. 11-12-13—Chicago, Master Driver contest.
Oct. 13—Richmond, Va., Track Race.
Oct. 13—Chicago Speedway Race.
Oct. 27—New York Speedway Race.
Oct. 24—Columbus, Ohio, Dixie Highway tour.

SHOWS

Oct. 1-6—Buffalo, N. Y., Closed Car Show, Automobile Dealers' Assn., Elmwood Music Hall.
Oct. 1-13—Wichita, Kan., Show.
Oct. 6-13—Boston, Closed Car Show, Boston Automobile Dealers' Assn.
Oct. 6-13—Cincinnati Automobile Show, Music Hall, Cincinnati Automobile Dealers' Assn.
Oct. 10-17—New York, Electrical Exposition, Grand Central Palace.
Oct. 13-20—Atlanta, Ga., Atlanta Automobile Association. J. W. Ranshaw, Mgr.
Oct. 13-28—Dallas, Tex., Dallas Automobile & Accessory Dealers' Assn., State Fair.
Nov. 12-17—Los Angeles, Cal., Motor Car Dealers Assn. Billy Sunday Tabernacle.
Nov. 12-18—Denver, Col., Automobile Trades Assn., Show Committee, Auditorium. G. A. Wahlgreen, Mgr.

1918

Jan. 5-12—New York Show, Grand Central Palace, National Automobile Chamber of Commerce.
Jan. 19-26—New York, Motor Boat Show, Grand Central Palace, National Assn. of Engine and Boat Manufacturers.
Jan. 19-26—Montreal, Show, National Motor Show of Eastern Canada, Montreal Automobile Trade Assn.
Jan. 19-28—Montreal, Can., Montreal Automobile Trade Assn., Ltd., Almya Bldg., T. C. Kirby, Mgr.
Jan. 26-Feb. 2—Chicago National Show, Coliseum and Armory, National Automobile Chamber of Commerce.
Feb. 11-16—St. Louis, Mo., St. Louis Auto Mfrs. & Dealers' Assn., Robert E. Lee, Mgr.
Feb. 18-23—Newark, N. J., N. J. Auto Exhibition, Co. G, First Regiment Armory. Claude E. Holgate, Mgr.
Feb. 18-23—Des Moines, Ia., Des Moines Automobile Dealers' Assn., Coliseum. C. G. Van Vliet & Dean Schooler, Mgrs.
Feb. 18-23—Springfield, Ohio, Springfield Auto Trades Assn., Memorial Hall. C. S. Burke, Mgr.
Feb. 18-25 — Pittsfield, Mass State Guard, State Armory. James J. Callaghan, Mgr.
Feb. 18-27—So. Bethlehem, Pa., Fourth Annual, (cars 18-23; trucks 25-27), Coliseum. J. L. Elliott, Mgr.
Sept. 23-28—Chicago. National Accessory Show for Fords, Coliseum.

S. A. E. Calendar

Standard Division Meetings

OCTOBER

4—Lighting, Detroit.
5—Miscellaneous, Congress Hotel, Chicago.
6—Tractor, Congress Hotel, Chicago.

Engineering

American Railway Master Mechanics' Assn.
American Institute of Electrical Engineers.
Master Builders' Assn.
American Society of Heating and Ventilating Engineers.
Association Iron and Steel Electrical Engineers.
Mining and Metallurgical Society of America.
Society of Automotive Engineers.
Illuminating Engineering Society.
National Electric Light Assn.
National Gas Engine Assn.
American Society for Testing Materials.
American Institute of Metals.
American Foundrymen's Assn.
Society Naval Architecture and Marine Engineers.

OCTOBER

6—Assn. Iron & Steel Elec. Engrs. monthly meeting Phila. section.
8—Amer. Soc. Heat. & Vent. Engrs. monthly meeting Ill. section at Chicago.
9—Amer. Soc. Heat. & Vent. Engrs. monthly meeting Mich. section at Detroit.
10—Amer. Soc. eHat. & Vent. Engrs. monthly meeting Mass. section at Boston.
11—Amer. Soc. Heat. & Vent. Engrs. monthly meeting Penn. section at Phila.
13—Assn. Iron & Steel Elec. Engrs. monthly meeting Cleveland section.
15—Amer. Soc. Heat. & Vent. Engrs. monthly meeting New York section.
17-18-19—Amer. Gas. Inst. at Washington, D. C.
18—Mining & Met. Soc. Amer. monthly meeting New York section Engrs. Club.
20—Assn. Iron & Steel Elec Engrs. monthly meeting Pittsburgh section.

NOVEMBER

3—Assn. Iron & Steel Elec. Engrs. monthly meeting Phila. section.
8—Amer. Soc. Heat. & Vent. Engrs. monthly meeting Penn. section at Phila.
9—Amer. Soc. Heat. & Vent. Engrs. monthly meeting Ohio section at Cleveland.
10—Assn. Iron & Steel Elec. Engrs. monthly meeting Cleveland section.
12—Amer. Soc. Heat. & Vent. Engrs. monthly meeting Ill. section at Chicago.
12—Amer. Soc. Heat. & Vent. Engrs. monthly meeting Mich. section at Detroit.
13—Amer. Soc. Heat. & Vent. Engrs. monthly meeting Mass. section at Boston.
15—Mining & Met. Soc. Amer. monthly meeting New York section at Engrs. Club.
15-16—Soc. Naval Arch. & Marine Engrs. annual meeting.
17—Assn. Iron & Steel Elec. Engrs. monthly meeting Pittsburgh section.
19—Amer. Soc. Heat. & Vent. Engrs. monthly meeting New York section.

DECEMBER

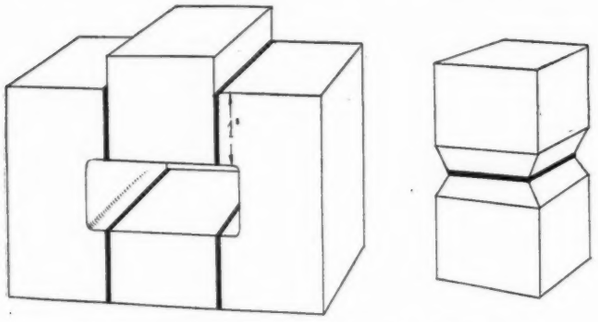
1—Assn. Iron & Steel Elec. Engrs. monthly meeting Phila. section.
8—Assn. Iron & Steel Elec. Engrs. monthly meeting Cleveland section.
10—Amer. Soc. Heat. & Vent. Engrs. monthly meeting Ill. section at Chicago.
11—Amer. Soc. Heat. & Vent. Engrs. monthly meeting Mich. section at Detroit.
13—Amer. Soc. Heat. & Vent. Engrs. monthly meeting Penn. section at Phila.
13—Amer. Soc. Heat. & Vent. Engrs. monthly meeting Ohio section at Cleveland.
15—Assn. Iron & Steel Elec. Engrs. monthly meeting Pittsburgh section.
17—Amer. Soc. Heat. & Vent. Engrs. monthly meeting New York section.
20—Mining & Met. Soc. Amer. Monthly meeting New York section at Engrs. Club.

Problems Considered at Aircraft Meeting

(*Continued from page 577*)

1 in. thick, 4 ft. long and 5½ in. wide. The gluing must represent actual practice, and no special precautions other than those ordinarily used shall be taken in preparing the glue or wood for the test specimen. The gluing shall be performed by the employees of the airplane factory who are accustomed to handling this kind of work. No protective coating of any kind shall be applied to the wood surface or to the finished specimen. The specimen shall set not longer than one week. The 4-ft. specimen shall be cut lengthwise and 10 shear blocks cut from each half according to the dimensions given on sketch. The shear blocks shall be tested as follows:

(a) Ten of the shear blocks shall be tested immediately



Shear and tension test specimens for glue tests

after sawing. The strength of the glue in shear shall not be less than that of the wood.

(b) Ten of the shear blocks shall be soaked in water at 20 deg. C. for 15 hr. and tested within 30 min. after removal from the water, without any preliminary drying. The strength after soaking shall not decrease more than 60 per cent.

The required strength shall be obtained for 80 per cent of the samples tested under each condition.

A rejected propeller may be substituted for the 4-ft. specimen specified above.

Inspection and Marking

The tests at the glue factory shall be made by or under the personal supervision of a glue expert authorized by the purchaser to make such test. The tests shall be made on every run of glue which is to be used in airplane construction.

The tests at the airplane factory shall be in the presence of an inspector for the purchaser regularly stationed at the factory and familiar with the methods employed there. A test shall be made whenever a brand of glue is changed or a change is made in the method of gluing, which, in the opinion of the purchaser's inspector, is important enough to warrant a test.

Glue

The glue which has been tested at the glue factory shall be barreled in the presence of the purchaser's representative and marked with the run number, rate of run, and inspector's stamp. The glue which is marked in this manner may be sold as certified glue for airplane construction.

Mr. Riddell of Canadian Aeroplanes, Ltd., said that in testing glue he had used a test specimen like the second shown in the committee report and found that many specimens did not fail in shear but split apart. He therefore adopted a shear test specimen as shown herewith, which is glued up of three pieces and then has a slot cut through it at the center. The specimen should preferably be placed on a block of soft wood when subjected to the shearing pressure.

A tension test is also being considered by the committee, in addition to the shear test, as it is plain that in a propeller, for instance, the strain on the glued joints is not pure shear strain. In this connection a sketch was shown of the British tension test specimen for glue and is reproduced herewith. It consists of two wood blocks beveled at the edges of the surfaces on which they are glued together. Mr. Riddell stated that the British test for glue for ply wood called for soaking the wood for three hours in water at from 100 to 110 deg. F., and that it had been found very difficult to meet this test.

Another subject down on the program was that of wing attachments, but from a report to Mr. Hanks by G. C. Loening, under date of Sept. 7, it appeared that nothing could be done in this matter at the present time.

John B. Tuttle, associate chemist of the Bureau of Standards, presented a brief report on rubber hose for gasoline connections. Mr. Manly said that neither the British nor the French aerial forces at the present time had an entirely satisfactory type of gasoline tube. Mr. Riddell of Canadian Aeroplanes, Ltd., said that flexible metal tubing was not satisfactory because it developed leaks, and copper tubing often failed in service owing to excessive vibration, so that the Royal Flying Corps now insisted on rubber tubing for gasoline. Metal tubing is, however, still being used for oil and air lines. The discussion brought out that when rubber is used for carrying gasoline it swells and the effective inside diameter is very much decreased. Mr. Tuttle stated that a tube had been developed recently by one of the large rubber companies which seemed to meet all requirements satisfactorily.

List of those present at meeting of Aircraft Division of the S. A. E. Standards Committee

Frederick A. Aspinwall, Signal Corps.
A. K. Atkins, Lt.-Comm. U. S. N.
Lewis H. Austin, Perry-Austin Mfg. Co.
Lieut. Blood.
F. W. Caldwell, Signal Corps.
Capt. Carlo Tappi, Italian Av. Corps.
John R. Cautley, Wright-Martin Airpl. Corp.
Lt. Felice Testoni, Italian Av. Corps.
Capt. E. C. Thibault de Chauvalon, French Aviation Comm.
C. F. Clarkson, S. A. E.
Hubert Chase, S. A. E.
Roger Chauveaux, Signal Corps.
Jasper E. Crane, Chem. Dep., Du Pont de Nemours & Co.
H. E. Coffin, Chairman, Aircraft Prod. Board.
James W. Davis, The Burgess Co., Marblehead, Mass.
Dr. H. C. Dickinson, Bureau of Standards.
Wm. F. Doerflinger, Perry-Austin Mfg. Co., New York.
F. S. Duesenberg, Duesenberg Motors Corp.
F. J. Diffin, Washington, D. C.
E. H. Ehrman, Chicago.
Edwin L. Georger, Pratt & Lambert, Buffalo, N. Y.
A. R. Gormully, Fiat.
B. D. Gray, Signal Corps.
Ely Griswold, Griswold Mfg. Co., Erie, Penna.
J. E. Hale, Goodyear Tire & Rubber Co., Akron, O.
M. W. Hanks, S. A. E.
Daniel F. Harriman, Wright-Martin Aircraft Corp.
Louis P. Hammett.
Spencer Heath, Baltimore.
P. M. Heldt, Class Journal Co., New York.
F. W. Herz, National Varnish Co.
W. H. Hill, Signal Corps.
Thomas H. Huff, Standard Aircraft Corp.
Naval Constructor Hunsaker, U. S. N.
Howard Huntington, Huntington Aircraft Co., Princeton, N. J.
J. B. Johnson, Signal Corps.
Charles B. King, Signal Corps.
Fred H. Lane, Chief Chemist, Emil Calman & Co., New York.
A. D. T. Libby, Splitdorf Electrical Co., Newark, N. J.
G. C. Loening, Consulting Engineer, Long Island City, N. Y.
C. W. McLaughlin, Signal Corps.
James D. Macgregor, Signal Corps.
Hugh McIsaac, W. S. Aero Corp. of Cal.
C. M. Manly, Curtiss Airplane Corp.
Captain Howard Marmon.
Carl T. Mason, Splitdorf Electrical Company.
Paul D. Merrick, Bureau of Standards.
Lieut. A. Mignot.
J. J. Moosman, E. I. Du Pont de Nemours & Co.
Capt. Stafford Montgomery.
F. L. Morse, Ithaca, N. Y.
H. E. Morton, B. F. Sturtevant Co., Boston, Mass.
G. L. Morris.
Howard B. Oakleaf, Signal Corps.
S. H. Page, Union Gas Engine Co., San Francisco.
E. E. Pennewill, Standard Aero Corp., New York.
John A. Pierson, Wright-Martin Airplane Corp.
R. E. Plympton, S. A. E.
Lieut. W. F. Prentice, Br. Aero Supply Dep.
Lawson Valentine Pulsifer, Valentine & Co., New York.
M. R. Riddell, Canadian Aeroplanes, Ltd., Toronto.
O. C. Rohde, Champion Spark Plug Co., Toledo, O.
John E. Sloan, Signal Corps.
W. H. Smith, Bureau of Standards.
G. B. Spear, Signal Corps.
Lieut. D'Amico, Stefano Italian Av. Corps.
Carl E. Sullivan, Signal Corps.
Rolf Thelen, U. S. Forest Service.
John B. Tuttle, Bureau of Standards.
Lieut. Ferrucio Vezzani, Italian Av. Corps.
Major J. G. Vincent, U. S. A.
J. H. Waterbury, Pratt & Lambert, Buffalo.
Charles F. Willard, Aeromarine Plane & Motor Co., New York.
Lieut. L. M. Woolson.
O. C. Wysong, Wysong & Miles Co., Greensboro, N. C.